PB-215 243

REPORT ON THE IMMEDIATE WATER POLLUTION CONTROL NEEDS FOR THE INTERSTATE AND INTRASTATE WATERS OF THE ST. LAWRENCE REGION

Federal Water Pollution Control Administration
Metuchen, New Jersey

June 1967

DISTRIBUTED BY:

NTIS

National Technical Information Service
U. S. DEPARTMENT OF COMMERCE
5285 Port Royal Road, Springfield Va. 22151

PB 215 243

REPORT ON THE

IMMEDIATE WATER POLLUTION CONTROL NEEDS

FOR THE

INTERSTATE AND INTRASTATE WATERS

OF THE

ST. LAWRENCE REGION

Reproduced by
NATIONAL TECHNICAL
INFORMATION SERVICE
U S Department of Commerce
Springfield VA 22151

U. S. DEPARTMENT OF THE INTERIOR

FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

HUDSON-CHAMPLAIN AND METROPOLITAN COASTAL
COMPREHENSIVE WATER POLLUTION CONTROL PROJECT

METUCHEN, NEW JERSEY

June 1967

TABLE OF CONTENTS

	Page
LIST OF TABLES	iii
I. INTRODUCTION	I-1
II. SUMMARY AND CONCLUSIONS	II-1
III. IMMEDIATE CONSTRUCTION NEEDS	
Introduction	III-1
Interstate Construction Needs	III-1
Needs by Priority	III-1
Needs by Type of Construction	III-2
Immediate Construction Costs, Interstate Waters	III-3
Intrastate Construction Needs	III-4
Needs by Priority	III-4
Needs by Type of Construction	III-4
Immediate Construction Costs, Intrastate Waters	III-5
IV. OTHER MANAGEMENT AND RESEARCH NEEDS	
Stream Surveillance Programs	IV-1
Storage and Stream Flow Regulation	IV-1
Operation and Maintenance	IV-2
Special Studies and Surveys	IV-3
V. RECENT PROGRESS IN POLLUTION CONTROL	
Interstate Action	V-1
Vermont	V-1
New York	V-2
Federal	V-4
VI. BACKGROUND FOR RECOMMENDATIONS	
Known Water Quality Problem Areas	VI-1
St. Regis River Basin	VI-1
Lake Champlain Basin	VI-1
Lake Memphremagog Basin	VI-6
Stream Categorization	VI-6
Municipal & Industrial Pollution Sources	VI-7
Other Pollution Sources	VI-8
Recreational and Commercial Navigation	VI-9
Septic Tanks and Cesspools	VI-10
Eutrophication and Aquatic Vegetation	VI-10
Stormwater Runoff	VI-11
Flow Regulation	VI-11
Camping	VI-11
Thermal Pollution	VI-12

Page

VII. DESCRIPTION OF THE AREA

Location. VII-1
Geology VII-1
Hydrography VII-2
Socio-Economic Characteristics. VII-3

VIII. WATER USE

Water Supply. VIII-1
Present Demands. VIII-1
Future Requirements. VIII-2
Recreation. VIII-3
Bathing. VIII-3
Recreational Boating VIII-3
Sport Fishing. VIII-4
Waterfowl. VIII-4
Commercial Boat Traffic VIII-5

APPENDIX A. . . . . CRITERIA FOR PRIORITY DETERMINATION

APPENDIX B. . . . . CONSTRUCTION ACTIVITY CODING

APPENDIX C. . . . . COST ESTIMATING PROCEDURES

MAP OF ST. LAWRENCE REGION

LIST OF TABLES

Table Number	Title	Page
II-1	Summary of Cost Data for Waste Source Abatement Through 1990 for Interstate Waters, St. Lawrence Region	II-5
II-2	Summary of Cost Data for Waste Source Abatement Through 1990 for Intrastate Waters, St. Lawrence Region	II-6
III-1	Immediate Construction Needs By Priority, Interstate Waters, St. Lawrence Region, Summary	III-6
III-2	Immediate Construction Needs By Priority, Interstate Waters, St. Lawrence Region, New York State	III-7
III-3	Immediate Construction Needs By Priority, Interstate Waters, St. Lawrence Region, Vermont	III-9
III-4	Immediate Construction Needs By Type, Interstate Waters, St. Lawrence Region, Summary	III-11
III-5	Immediate Construction Needs By Type, Interstate Waters, St. Lawrence Region, Municipal Needs	III-12
III-6	Immediate Construction Needs By Type, Interstate Waters, St. Lawrence Region, Industrial Needs	III-14
III-7	Immediate Construction Costs, Interstate Waters, St. Lawrence Region, Municipal Needs Through 1990	III-15
III-8	Immediate Construction Costs, Interstate Waters, St. Lawrence Region, Industrial Needs Through 1990	III-16
III-9	Immediate Construction Needs By Priority, Intrastate Waters, St. Lawrence Region, Summary	III-17
III-10	Immediate Construction Needs By Priority, Intrastate Waters, St. Lawrence Region, New York State	III-18
III-11	Immediate Construction Needs By Priority, Intrastate Waters, St. Lawrence Region, Vermont	III-19
III-12	Immediate Construction Needs By Type, Intrastate Waters, St. Lawrence Region, Summary	III-21
III-13	Immediate Construction Needs By Type, Intrastate Waters, St. Lawrence Region, Municipal Needs	III-22

LIST OF TABLES

Table Number	Title	Page
III-14	Immediate Construction Needs By Type, Intrastate Waters, St. Lawrence Region, Industrial Needs	III-24
III-15	Immediate Construction Costs, Intrastate Waters, St. Lawrence Region, Municipal Needs Through 1990	III-25
III-16	Immediate Construction Costs, Intrastate Waters, St. Lawrence Region, Industrial Needs Through 1990	III-26
VI-1	Stream Category Designation Inter- and Intrastate Streams	VI-13
VI-2	Waste Sources in St. Lawrence Region, Summary	VI-17
VII-1	Distribution and Projection of Population in St. Lawrence Region by State and County, 1960 and 1990	VII-6
VIII-1	Inventory of Municipal Water Facilities, St. Lawrence Region	VIII-6
A-1	Priority Criteria - Municipal Wastes	Appendix A
A-2	Priority Criteria - Industrial Wastes	Appendix A-1
B-1	Municipal Construction Activity Codes	Appendix B
B-2	Industrial Contruction Activity Codes	Appendix B-1

I - INTRODUCTION

This report reviews the water pollution problems in the St. Lawrence Region, which is defined to include all streams draining to the St. Lawrence River from the St. Regis River in New York on the west to Lake Memphremagog in Vermont on the east. The major drainage basin within the Region is that of Lake Champlain. The discharge of waste from municipalities, industries, and numerous other sources degrades water quality and prevents full utilization of the natural resources throughout the Region.

The purpose of this report is to delineate those actions which should be undertaken immediately to prevent further degradation and to provide enhancement of these waters. These actions include not only construction of new or improved municipal and industrial waste treatment facilities, but also studies, surveys and research which are needed to develop sound water quality management programs for the future.

The recommendations included in this report are based upon a preliminary analysis of the data obtained from published reports, from state agency files, and from the files of the Federal Water Pollution Control Administration. The recognition of the inadequacy of these data indicates the need for additional studies and for field surveys to augment available information and to further verify the contents of this report. In preparing these recommendations the needed construction activities were determined in order of priority of urgency, using the available data and a scoring procedure described in the Appendix.

This report has been prepared under the authority of the provisions of the Federal Water Pollution Control Act, as amended, and in accordance with Presidential Executive Order 11288, "Prevention, Control and Abatement of Water Pollution by Federal Activities."

II - SUMMARY AND CONCLUSIONS

1. This report covers the St. Lawrence Region, composed of those three major drainage basins located in the Northeastern section of New York and most of the western half of Vermont which drain northward to the St. Lawrence River. These basins are the St. Regis River, Lake Champlain and Lake Memphremagog. The inter- and intrastate waters of the Region receive the discharges of wastes from municipal collection and waste treatment systems, industries, individual sewerage systems, boating and land drainage. Many of these waters are polluted with organic wastes, bacteria, suspended solids, toxic chemicals and nutrients.

2. The governmental agencies within the Region which have direct responsibility for water pollution control are the New York State Department of Health, the Vermont Department of Water Resources and the Federal Water Pollution Control Administration. Assistance and/or coordination is provided by the New England Interstate Water Pollution Control Commission, and the Interstate Commission on Lake Champlain. While the latter has existed as a quasi-official agency, action is underway to create a formal compact to establish a New York-Vermont agency to conduct planning and management for Lake Champlain.

3. Pollution of these waters not only presents a hazard to the health of persons using them for water supply and water contact recreation, but also restricts full utilization for fish and wildlife, industrial and agricultural needs, and presents an unsightly and objectionable appearance. Such degradation can result in deterioration of much of the regional economy, which is based in large part on recreation and similar water based activities.

4. The major sources of pollution of these waters are raw and inadequately treated municipal and industrial wastes. There are 117 known municipal, Federal and industrial sources of waste which affect interstate or intrastate waters and which require pollution abatement action. On the basis of BOD, the industrial waste loadings are approximately three times as great as that from municipalities. Major industrial sources include the pulp and paper industry, which accounts for over 90 percent of the total industrial waste load, dairy operations, soft drink bottling, light manufacturing operations, and stone cutting and finishing.

5. The interstate waters of the Region are affected by the discharge of inadequately treated wastes from 46 municipalities, one Federal installation and 22 industries. Of the municipal sources, 21 provide no treatment, and an additional 10 have primary plants which are obsolete. At least 26 municipalities do not disinfect waste prior to discharge. Of the 22 industries, six, all paper and

pulp operations, account for about 98 percent of the total industrial BOD loading.

6. There are a total of 41 municipal and seven industrial sources which affect the intrastate waters within the Region. Of the municipal sources, 26 discharge with no treatment and an additional six have primary treatment plants which are obsolete.

7. To achieve satisfactory water quality, all municipal and industrial sources should receive a minimum of secondary treatment which is defined as 90 percent BOD removal and 95 percent removal of suspended solids. In addition, all municipal and most industrial wastes should receive effective disinfection. In certain cases, removal of nutrients and toxic materials are required in addition to the above. These criteria served as guidelines to determine immediate construction needs and to calculate cost estimates for this report.

8. The estimated cost to abate the pollution of the interstate waters is presented in Table II-1 and totals $39,000,000, of which $20,000,000 is needed for construction of municipal waste treatment facilities, and $19,000,000 needed for industrial abatement.

9. The estimated cost to abate the pollution of the intrastate waters is presented in Table II-2, and totals $12,000,000, of which nearly all is needed for construction of municipal waste treatment facilities.

10. In addition to the waste discharges from municipalities and industries, water quality within the Region is degraded to an unknown degree by wastes from such sources as individual septic tanks and cesspools, combined sewers and urban runoff, recreational and commercial boating, agricultural runoff, camping sites, by heat from power plants and industries, and by natural aging and enrichment of the lakes.

11. To promote the control of pollution from waste sources, and to ensure that the funds which must be expended for immediate construction activity result in improved water quality, additional legislation, studies, and planning will be required.

12. The State of Vermont should adopt and implement laws that will:

a. Prohibit dumping of litter and disposal of untreated waste from watercraft;

b. Establish a state-wide sampling and monitoring program;

c. Provide for adequate operation and maintenance of waste treatment plants, including licensing of operators.

13. Vermont should adopt and implement additional laws which recognize the need for regional planning in water resource development and require local governments to consider regional plans in terms of water supply and waste treatment.

14. The Federal Water Pollution Control Administration should assist current state programs in cooperative studies, surveys and research in the following areas:

a. Location of areas with high densities of individual septic tanks and cesspools, and the effects of such systems on surface and ground water quality;

b. Effects of stormwater overflow and urban runoff on water quality, and methods to control such sources;

c. Field sampling and laboratory analyses to determine present water quality in those areas where existing data are inadequate;

d. Types and amounts of agricultural chemicals used in the region, with a determination of the effects of runoff of such pollutants on the receiving waters;

e. Location of areas with obnoxious growths of aquatic weeds and algae, with control measures to reduce nutrient inflow to such waters as well as to eliminate present problems by physical removal or chemical control;

f. Location and extent of thermal pollution problems;

g. Accurate and current inventories of all sources of municipal and industrial waste, to include waste volumes and characteristics;

h. Feasibility of joint municipal-industrial treatment facilities, to include any needed pre-treatment of industrial waste;

i. Comprehensive basin planning to coordinate releases from power generation installations, navigation and other water resource development structures to enhance water quality during periods of critical low stream flow;

j. Magnitude of the problem of pollution by recreational and commercial boats, to include oil pollution, and needed control procedures to abate these sources of pollution; and

k. Training programs for waste treatment plant operators and state surveillance personnel to assure maximum treatment plant efficiencies;

15. The States of New York and Vermont should undertake additional studies, surveys and programs to cover the following:

a. Projects designed to replace ineffective individual waste disposal systems by municipal collection and treatment facilities;

b. Inventory boat marinas to determine the adequacy of present on-shore treatment devices; and satisfy the need for such devices to handle waste from recreational boating; and

c. Determination of the magnitude of pollution from camping facilities, and means to control such sources.

16. An investigation must be undertaken of the existing legal and institutional arrangements which deal with water quality problems on a local, regional or statewide basis to determine their adequacy in effecting and implementing water pollution control programs.

17. Investigations must be carried out to determine the fiscal contribution of each basin entity (government and private) to meet expenditures required for immediate and long range pollution control and resource management programs. The role of Federal, State, local and private bodies must be evaluated in terms of costs and benefits. An indication of the economic impact water pollution abatement may have on the Region as a whole should be determined if programs aimed at achieving better water quality are to receive an appropriate share of public and private expenditures.

18. The need for close coordination of water quality problems indicates that a regional approach is best suited to promote inter-local cooperation between municipalities, to coordinate planning among townships and counties, and to administer State and Federal programs. Regional water management authorities must ensure that the needs of the minor or tributary river basins are reviewed, weighed and/or integrated into the major river drainage basin programs.

TABLE II-1

SUMMARY OF COST DATA FOR WASTE SOURCE
ABATEMENT THROUGH 1990 FOR INTERSTATE WATERS
ST. LAWRENCE REGION

Priority [a]	Municipal No. Plants	Municipal Cost ($000)	Industrial No. Plants	Industrial Cost ($000)	Total [c] ($000)
I	1	160	6	17,310	17,470
II	21	7,160	10	990	8,150
III	5	1,240	6	330	1,570
IV	20	11,400	-	-	11,400
	47	19,960	22	18,630	38,590

Construction Activity Code (Municipal) [b]		
01	21	6,610
02	10	2,780
04	15	9,260
05	-	-
06	1	1,310
	47	19,960

Construction Activity Code (Industrial) [b]		
A	8	520
B	-	-
C	7	320
D	7	17,790
	22	18,630

[a] See Appendix A for priority criteria.

[b] See Appendix B for Construction Activity Codes.

[c] See Appendix C for municipal and industrial cost estimating procedures.

TABLE II-2

SUMMARY OF COST DATA FOR WASTE SOURCE
ABATEMENT THROUGH 1990 FOR INTRASTATE WATERS
ST. LAWRENCE REGION

Priority [a]	Municipal No. Plants	Municipal Cost ($000)	Industrial No. Plants	Industrial Cost ($000)	Total [c] ($000)
I	2	750	1	80	830
II	14	4,460	4	80	4,640
III	16	4,210	2	60	4,270
IV	9	2,250	-	-	2,250
	41	11,670	7	320	11,990

Construction Activity Code (Municipal) [b]		
01	26	4,990
02	6	2,750
04	6	3,870
05	3	60
	41	11,670

Construction Activity Code (Industrial) [b]		
A	4	210
B	1	60
C	2	50
D	-	-
	7	320

a/ See Appendix A for priority criteria.

b/ See Appendix B for Construction Activity Codes.

c/ See Appendix C for municipal and industrial cost estimating procedures.

III. IMMEDIATE CONSTRUCTION NEEDS

To determine the immediate corrective actions necessary to ensure the preservation, development and enhancement of natural waters within the Region, an evaluation was made of immediate construction needs for each known municipal and industrial waste source. Non-construction needs, including research and field studies, are discussed in Section IV of this Report. In developing the needed construction activity, it was recognized that secondary treatment was the minimum permissible to provide that the need for such water uses as water supply, recreation and sport-fishing could be met. Using this criteria, as well as such additional factors as dilution water available, strength and volume of waste discharge, existing treatment, and use of the receiving water, a system of priorities was formulated to identify the most significant problem areas.

All waste sources requiring corrective action were classified into one of four priority groupings ranked in descending order of urgency. Further details on the criteria used to develop these priorities are provided in the Appendix, but in general, those sources with relatively high population equivalents in terms of BOD loading, those with little or no treatment and those which discharge into streams which have only small amounts of dilution water were assigned the highest priorities.

The following sections present these immediate construction needs, together with estimated costs and priority, for both the interstate and intrastate waters of the St. Lawrence Region.

INTERSTATE CONSTRUCTION NEEDS

The interstate waters of the St. Lawrence Region are affected by 47 known municipal, institutional, and Federal waste discharges; and 22 known industrial waste sources which require some form of immediate construction to bring under control. These municipal waste sources serve an estimated 154,000 persons. At least 26 of these sources provide no disinfection of the waste. On a BOD basis, the industrial waste loadings have been estimated to be equivalent to that from 597,000 persons, nearly four times the municipal loading needing abatement.

Needs by Priority

Table III-1 summarizes the needed construction activity by priority of urgency. Tables III-2 and III-3 identify the specific sources in each priority by State. Priority I, those waste sources demanding the most urgent attention, includes one municipal and six industrial waste sources. The municipal source, located in New York discharges raw wastes from 700 persons. Six paper and pulp industries (five in New York and one in Vermont) representing an estimated total

waste load equivalent to 590,000 persons make up the industrial listing for Priority I. These wastes are characterized by large waste volumes, color, and high concentrations of BOD and solids. The International Paper Company of Ticonderoga, the Georgia Pacific Corporation of Plattsburgh, and the J. and J. Rogers Company of Ausable Forks, New York are the largest such mills in the area.

Priority II includes 21 municipal systems serving 37,000 persons and 10 industries discharging waste equivalent to 5,300 persons. Three municipal systems which discharge raw waste: Whitehall on the Mettawee River, Ticonderoga on Ticonderoga Creek, and Winooski on the Winooski River, are the largest municipal sources in Priority II. The industries in Priority II include food processing plants. such as dairy operations and slaughterhouses; and textiles operations. Waste from such industries are characterized by high BOD, suspended solids and bacteria, with relatively small waste volumes.

Of the 10 industrial sources, the 7 located in Vermont account for the estimated population equivalent of 4,500 persons. The largest industrial waste source in Priority II is the Fair Haven Mills, Fair Haven, Vermont, which discharges nearly three fourths of the BOD waste loading of this priority as well as some toxic materials into the Castleton River.

Included in Priority III are five municipal waste systems all in New York, which serve 6,000 persons. Of these sources, the Clinton Prison Hospital in Dannemora is the largest, and accounts for about 50 percent of the total population served by systems in this priority. There are also 6 industrial plants, one in New York, and five in Vermont, that have been classified as Priority III and which represent an aggregate estimated population equivalent of 1,000 persons.

The 20 municipal systems in the least urgent Priority IV category handle the wastes of 110,000 persons. Nine of these serving 47,000 persons are in New York State and 11 serving 64,000 persons are in Vermont. Six of the 20 sources in this category are primary treatment facilities that are either obsolete or in poor condition. No industrial facilities are included in the Priority IV category.

Needs by Type of Construction

Table III-4 summarizes immediate construction needs in the interstate waters by type of construction required. Table III-5 presents detailed needs by source for municipal systems and Table III-6 for industrial sources. Approximately 32,000 persons are served by 21 municipal collection systems that presently provide no treatment, and which will require construction of complete secondary treatment facilities. Eleven of the systems serving 13,000 persons are located in

New York, and 10 others, serving 19,000, are in Vermont.

There are 10 plants, 8 in New York and 2 in Vermont, which were built to provide primary treatment but are now obsolete and should be replaced by new secondary treatment facilities. These plants serve an estimated 13,000 persons.

There are 15 primary plants serving nearly 100,000 persons which must be upgraded to provide secondary treatment. Six of these serving about 50,000 persons are located in New York. There is one substantially overloaded secondary plant in St. Albans, Vermont which requires upgrading and expansion.

Of the industrial sources which require construction of some type, there are 7 facilities, including all the pulp and paper mills, (6), accounting for 98 percent of the 597,000 total estimated population equivalent that require appropriate segregation of wastes, biological treatment and disinfection. Seven other industrial firms with relatively low PE discharges need segregation of waste and non-biological treatment. The remaining 8 industrial plants require only construction of appropriate secondary treatment facilities.

Immediate Construction Costs, Interstate Waters

The estimated costs of the construction needs for interstate waters are summarized in Tables III-7 (municipal costs) and III-8 (industrial costs). To finance this program of immediate pollution abatement of the interstate waters in the St. Lawrence Region will require an estimated total expenditure of at least $39,000,000. Of this total, 52 percent is needed to provide secondary treatment plus chlorination to all municipal waste sources; the balance is to provide treatment to industrial discharges. The costs include plant capacity sufficient to serve the anticipated population projected to 1990. Details on the procedure used for cost estimation are in Appendix C.

An unusually large cost disparity between municipal and industrial offenders occurs in Priority I. Although there is only one municipal system in this catagory requiring urgent action with an expenditure of about $200,000, there are six industrial plants in Priority I which discharge wastes roughly equivalent to that from a city the size of Buffalo. To control these industrial discharges will require an expenditure of over $17 million.

Although the data in Tables III-1 and III-4 indicate the industrial BOD load is almost four times that from municipal sources, the estimated cost to correct the industrial waste problem is slightly smaller than that for municipalities. This is due to the following factors:

1) the economy of large scale construction facilities--one industrial plant (International Paper Corp., Ticonderoga, N.Y.) accounts for approximately 316,000 P.E.'s or 53 percent of the entire industrial load. This concentration of load contrasts with the largest municipal facility, Plattsburgh which serves only 27,000 persons;

2) the smaller amount required by industry for ancillary systems--for municipal systems, ancillary works were estimated at 83 percent of the plant cost, while for industry the ancillary cost factor was only 50 percent of the treatment plant cost.

INTRASTATE CONSTRUCTION NEEDS

There are 41 municipal and 7 industrial waste sources that discharge raw or inadequately treated waste to the intrastate waters of the St. Lawrence Region. Thirty-six of the municipal sources, representing a sewered population of 69,000 persons, are in Vermont; five, with a sewered population of 11,000 persons are in New York. All of the industrial sources, with an estimated BOD loading equivalent to only 1,000 persons, are in Vermont. Of the 35 municipal sources, 29 do not disinfect their waste discharges.

Needs by Priority

Table III-9 summarizes the immediate construction needs for intrastate waters by priority of urgency. Tables III-10 and III-11 present the priorities by individual source for New York and Vermont respectively. Priority I includes two municipal facilities and one industrial source, all in Vermont. Fourteen municipal sources are in Priority II and 16 are in Priority III. The remaining nine municipal sources are in Priority IV. Included in Priority IV is one Federal facility which provides intermediate treatment for the wastes of 200 persons.

The seven industrial sources included in the intrastate category are located in Vermont. These industries include four milk and dairy processing plants, one slaughterhouse, and two materials (talc, inert pigment and crushed lime) manufacturing operations.

Needs by Type of Construction

Construction needs by type of facility are summarized in Table III-12, while Tables III-13 and III-14 present detailed needed construction for municipal and industrial sources respectively. Twenty-six municipal sources discharge untreated waste and require construction of complete secondary treatment and chlorination facilities. Six existing primary plants are obsolete and must be abandoned and replaced

by new secondary treatment works, while six primary plants are suitable for expansion and upgrading to secondary treatment. In addition, there are three intermediate plants capable of being upgraded.

Of the industrial sources, two require segregation of wastes and separate treatment with chlorination, and five require conventional secondary treatment.

Immediate Construction Costs, Intrastate Waters

The estimated costs to construct the needed treatment facilities to abate wastes discharged to intrastate waters are presented in Tables III-15 (municipal) and III-16 (industrial). The total cost for both municipal and industrial pollution control needs on intrastate waters is estimated to be $12 million, of which municipal construction activity will require $11.7 million or 99 percent of the total. Most of this expenditure, $10 million, is needed to correct the problem in Vermont.

More than half of the municipal costs must be expended to either replace obsolete primary facilities with plants providing secondary treatment, or to construct entirely new secondary treatment facilities for those sources which discharge raw wastes.

TABLE III-1

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTERSTATE WATERS, ST. LAWRENCE REGION
SUMMARY [a]

Priority [b]	New York		Vermont		Total	
	No.	Pop. [c]	No.	Pop. [c]	No.	Pop. [c]
Municipal, Institutional and Federal						
I	1	700	-	-	1	700
II	10	17,500	11	19,100	21	36,600
III	5	5,700	-	-	5	5,700
IV	9	47,100	11	63,500	20	110,600
	25	71,000	22	82,600	47	153,600
Industrial						
I	5	560,300	1	30,000	6	590,300
II	3	800	7	4,500	10	5,300
III	1	na	5	1,000	6	1,000
IV	-	-	-	-	-	-
	9	561,100	13	35,500	22	596,600
Totals						
I	6	561,000	1	30,000	7	591,000
II	13	18,300	18	23,600	31	41,900
III	6	5,700	5	1,000	11	6,700
IV	9	47,100	11	63,500	20	110,600
	34	632,100	35	118,100	69	750,200 [d]

[a] See Table III-2 and III-3 for listing of individual sources.

[b] See Appendix A for priority criteria.

[c] Population served for municipal sources; population for industrial sources based upon population equivalents determined on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD per day.

[d] Total of known population served and calculated population equivalents.

TABLE III-2

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTERSTATE WATERS, ST. LAWRENCE REGION
NEW YORK STATE

Waste Source	Construction Activity Code [a]	Population Served (000) [b]
Priority I [c]		
A. Municipal		
Westport	01	0.7
		0.7
B. Industrial		
International Paper Co.	D	316.0
Rogers J & J	D	52.8
Imperial Paper Co.	D	16.2
Diamond National Corp.	D	18.3
Georgia Pacific Corp., Plattsburgh	D	157.0
		560.3
		561.0
Priority II [c]		
A. Municipal		
Chateaugay	01	1.2
White Hall	01	4.9
Port Henry	04	1.8
Rouses Point	04	2.2
Ticonderoga	01	3.0
Mineville	02	1.8
Keeseville	01	0.3
Peru	02	0.9
Dannemora	01	0.8
Chazy	01	0.6
		17.5
B. Industrial		
American Graphite Co.	C	na
Republic Steel Corp.	C	na
Champlain Creameries	A	0.8
		0.8
		18.3
Priority III [c]		
A. Municipal		
Willsboro	01	0.9
St. Regis Falls	01	0.2
Brainardsville	01	0.1
Dannemora #2	04	1.5
		2.7

TABLE III-2

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTERSTATE WATERS, ST. LAWRENCE REGION
NEW YORK STATE (Cont'd)

Waste Source	Construction Activity Code [a]	Population Served (000) [b]
	Priority III (Cont'd) [c]	
B. Industrial		
Adirondack Essential Oil	C	na
C. Institutional		
Clinton Hill Prison Hospital	02	3.0
		3.0
		5.7
	Priority IV [c]	
A. Municipal		
Fort Covington	02	1.3
Winthrop	01	na
Hogansburg	02	0.4
Malone	04	11.5
Fort Ann	02	0.5
Granville	02	4.0
Plattsburgh	04	27.0
Champlain	04	1.5
		46.2
B. Industrial		
None		
C. Federal		
FHA Housing, Grover Hill	02	0.9
		0.9
		47.1
	TOTAL	632.1 [d]

a/ See Tables III-5 and III-6 for definitions of Construction Activity Codes.
b/ Population served for industrial sources is the population equivalent on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD per day.
c/ See Appendix A for priority criteria.
d/ Total of known population served and calculated population equivalents.
na Data not available.

TABLE III-3

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTERSTATE WATERS, ST. LAWRENCE REGION
VERMONT

Waste Source	Construction Activity Code [a]	Population Served (000) [b]
Priority I [c]		
A. Municipal		
None		
B. Industrial		
Missisquoi Specialty Board Division, Sheldon Springs	D	30.0
		30.0
		30.0
Priority II [c]		
A. Municipal		
Fair Haven	01	1.8
Poultney	01	1.5
Winooski	01	7.0
Colchester F.D. #1	01	2.0
Fairfax	01	1.2
North Troy	01	0.4
Richford	01	1.4
Montgomery Center	01	0.8
Enosburg Falls	01	1.2
Swanton	01	1.5
Alburg	02	0.3
		19.1
B. Industrial		
Fair Haven Mills, Inc., Fair Haven	D	3.6
Vermont Assoc. Lime Ind., New Haven Jct.	C	na
Vermont Assoc. Lime Ind., Colchester	C	na
John McKenzie Packing Co., Burlington	A	0.2
United Farmers of N. E., Troy	A	0.1
Kraft Foods, Inc., Troy	A	0.3
Vermont Dressed Beef Co., Swanton	A	0.3
		4.5
		23.6

TABLE III-3

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTERSTATE WATERS, ST. LAWRENCE REGION
VERMONT (Cont'd)

Waste Source	Construction Activity Code [a]	Population Served (000) [b]
	Priority III [c]	
A. Municipal		
None		
B. Industrial		
IBM, Essex Junction	C	0.1
United Farmers of N. E., Inc., Enosburg Falls	A	0.1
Precision Metal Prod. Corp., Swanton	C	0.5
Franklin County Cheese Corp., Enosburg Falls	A	0.1
H. P. Hood & Sons, Newport	A	0.2
		1.0
		1.0
	Priority IV [c]	
Municipal		
Castleton	02	0.3
Essex Junction	04	5.0
Burlington (Main Plant)	04	22.0
Burlington (North End)	04	9.0
Burlington (Riverside)	04	6.2
St. Albans	06	9.0
Vergennes	04	2.0
S. Burlington (B.B.)	04	3.0
S. Burlington (M.P.)	04	2.0
Shelbourne #2	04	0.5
Newport	04	4.5
		63.5
	TOTAL	118.1 [d]

a/ See Tables III-5 and III-6 for definitions of Construction Activity Codes.
b/ Population served for industrial sources is the population equivalent on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD per day.
c/ See Appendix A for priority criteria.
d/ Total of known population served and calculated population equivalents.
na Data not available.

TABLE III-4

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTERSTATE WATERS, ST. LAWRENCE REGION
SUMMARY [a]

Construction Activity Code [b]	New York		Vermont		Total	
	No.	Pop. [c]	No.	Pop. [c]	No.	Pop. [c]
Municipal, Institutional and Federal						
01	11	12,700	10	18,800	21	31,500
02	8	12,800	2	600	10	13,400
04	6	45,500	9	54,200	15	99,700
05	-	-	-	-	-	-
06	-	-	1	9,000	1	9,000
	25	71,000	22	82,600	47	153,600
Industrial						
A	1	800	7	1,300	8	2,100
B	-	-	-	-	-	-
C	3	na	4	600	7	600
D	5	560,300	2	33,600	7	593,900
	9	561,100	13	35,500	22	596,600
TOTALS		632,100		118,100		750,200 [d]

[a] See Tables III-5 and III-6 for listing of individual sources.

[b] See Tables III-5 and III-6 for identification of Construction Activity Codes.

[c] Population served for municipal sources; Population for industrial sources based upon the population equivalents determined on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD per day.

[d] Total of known population served and calculated population equivalents.

TABLE III-5

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTERSTATE WATERS, ST. LAWRENCE REGION
MUNICIPAL NEEDS

Waste Source	Population Served (000)
Code 01: Discharging raw sewage. Build secondary plant.	
New York	
Willsboro	0.9
Keesville	0.3
Westport	0.7
Chateaugay	1.2
White Hall	4.9
Ticonderoga	3.0
Dannemora	0.8
Chazy	0.6
St. Regis Falls	0.2
Brainardsville	0.1
Winthrop	na
	12.7
Vermont	
Fair Haven	1.8
Poultney	1.5
North Troy	0.4
Richford	1.4
Enosburg Falls	1.2
Swanton	1.5
Winooski	7.0
Fairfax	1.2
Montgomery Center	0.8
Colchester	2.0
	18.8
	31.5
Code 02: Not suitable for upgrading to secondary. Build new primary and upgrade to secondary.	
New York	
Hogansburg	0.4
Fort Ann	0.5
Mineville	1.8
Peru	0.9
Fort Covington	1.3
Clinton Hill Prison Hospital (Institutional)	3.0
Granville	4.0
FHA Housing, Glover Hill (Federal)	0.9
	12.8

TABLE III-5

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTERSTATE WATERS, ST. LAWRENCE REGION
MUNICIPAL NEEDS (Cont'd)

Waste Source	Population Served (000)
Code 02: Not suitable for upgrading. Build new primary and secondary. (Cont'd)	
Vermont	
Alburg	0.3
Castleton	0.3
	0.6
	13.4
Code 04: Primary suitable for upgrading; build secondary facilities.	
New York	
Port Henry	1.8
Rouses Point	2.2
Dannemora #2	1.5
Malone	11.5
Plattsburgh	27.0
Champlain	1.5
	45.5
Vermont	
S. Burlington	2.0
Burlington (Main Plant)	22.0
Essex Junction	5.0
Burlington (North End)	9.0
Burlington (Riverside)	6.2
Vergennes	2.0
S. Burlington (B.B.)	3.0
Shelburne #2	0.5
Newport	4.5
	54.2
	99.7
Code 05: Intermediate suitable for upgrading; build secondary facilities.	
None	
Code 06: Secondary plant presently overloaded but in good condition. Build new facilities to handle overload.	
Vermont	
St. Albans	9.0
	9.0
TOTAL	153.6 a/

a/ Total of known population served.
na Data not available.

TABLE III-6

IMMEDIATE CONSTRUCTION NEEDS BY TYPE, INTERSTATE WATERS,
ST. LAWRENCE REGION, INDUSTRIAL NEEDS

Waste Source	Population Equivalent (000)
Code A: Provide secondary treatment or equivalent plus chlorination.	
New York	
Champlain Creameries, Champlain	0.8
	0.8
Vermont	
McKenzie Packing Co., Burlington	0.2
United Farmers of N. E., Troy	0.1
Kraft Food, Troy	0.3
Vermont Dressed Beef, Swanton	0.3
United Farmers of N. E., Enosburg	0.1
Franklin County Cheese, Enosburg Falls	0.1
H. P. Hood and Sons, Newport	0.2
	1.3
	2.1
Code B: Provide secondary treatment or equivalent.	
None	
Code C: Segregate and separate treatment for one or more waste types.	
New York	
American Graphite Co., Ticonderoga	na
Republic Steel Corp., Mineville	na
Adirondack Essential Oil, Willsboro	na
Vermont	
Vermont Assoc. Lime, New Haven Junction	na
Vermont Assoc. Lime Ind., Colchester	na
Precision Metal Prod. Corp., Swanton	0.5
IBM, Essex Junction	0.1
	0.6
	0.6
Code D: Same as C; with biological treatment plus chlorination for all or part of the waste load.	
New York	
International Paper Co., Ticonderoga	316.0
Rogers J & J, Ausable Forks	52.8
Imperial Paper Co., Plattsburgh	16.2
Diamond National Corp., Plattsburgh	18.3
Georgia Pacific Corp., Plattsburgh	157.0
	560.3
Vermont	
Missisquoi Specialty Board Division, Sheldon Springs	30.0
Fair Haven Mills, Fair Haven	3.6
	33.6
	593.9
TOTAL	596.6 a/

a/ Total of calculated population equivalents.
na Data not available.

TABLE III-7

IMMEDIATE CONSTRUCTION COSTS,
INTERSTATE WATERS, ST. LAWRENCE REGION,
MUNICIPAL NEEDS THROUGH 1990

Priority [a]	No. Plants N.Y.	No. Plants Vt.	Estimated Plant Cost ($000) [b] N.Y.	Estimated Plant Cost ($000) [b] Vt.	Estimated Cost Ancillary Work ($000) [c] N.Y.	Estimated Cost Ancillary Work ($000) [c] Vt.	Total By State ($000) N.Y.	Total By State ($000) Vt.	Total ($000)
I	1	-	90	-	70	-	160	-	160
II	10	11	1,570	2,340	1,310	1,940	2,880	4,280	7,160
III	5	-	680	-	560	-	1,240	-	1,240
IV	9	11	1,770	4,450	1,480	3,700	3,250	8,150	11,400
	25	22	4,110	6,790	3,420	5,640	7,530	12,430	19,960
Construction Activity Code [a]									
01	11	10	1,310	2,300	1,090	1,910	2,400	4,210	6,610
02	8	2	1,370	140	1,150	120	2,520	260	2,780
04	6	9	1,430	3,630	1,180	3,020	2,610	6,650	9,260
05	-	-	-	-	-	-	-	-	-
06	-	1	-	720	-	590	-	1,310	1,310
	25	22	4,110	6,790	3,420	5,640	7,530	12,430	19,960

a/ See Table III-5 for Construction Activity Code and Appendix A for priority criteria.

b/ Estimated plant cost = (1966 population served) x (factor projected to year 1990) x (unit cost per capita) x (projected 1970 FWPCA construction cost index) x (factor for engineering, legal and other fees).

c/ Estimated cost for ancillary work (interceptors, outfalls, pumping stations, etc.) = (Estimated cost of plant) x (.83).

TABLE III-8

IMMEDIATE CONSTRUCTION COSTS,
INTERSTATE WATERS, ST. LAWRENCE REGION,
INDUSTRIAL NEEDS THROUGH 1990

Priority [a]	No. Plants N.Y.	No. Plants Vt.	Estimated Plant Cost ($000) [b] N.Y.	Estimated Plant Cost ($000) [b] Vt.	Estimated Cost Ancillary Work ($000) [c] N.Y.	Estimated Cost Ancillary Work ($000) [c] Vt.	Total By State ($000) N.Y.	Total By State ($000) Vt.	Total ($000)
I	5	1	10,370	1,170	5,180	590	15,550	1,760	17,310
II	3	7	130	500	70	290	200	790	990
III	1	5	20	200	10	100	30	300	330
IV	-	-	-	-	-	-	-	-	-
	9	13	10,520	1,870	5,260	980	15,780	2,850	18,630
Construction Activity Code [a]									
A	1	7	100	250	50	120	150	370	520
B	-	-	-	-	-	-	-	-	-
C	3	4	50	160	30	80	80	240	320
D	5	2	10,370	1,460	5,180	780	15,550	2,240	17,790
	9	13	10,520	1,870	5,260	980	15,780	2,850	18,630

[a] See Table III-6 for Construction Activity Code and Appendix A for priority criteria.

[b] Estimated plant cost = (1966 population equivalents x water use factor projected to year 1990) x (unit cost per capita) x (projected 1970 FWPCA construction cost index) x (factor for engineering and other fees).

[c] Estimated cost for ancillary work (process changes, segregation and collection systems, etc.) = (estimated cost of plant) x (.50).

TABLE III-9

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY,
INTRASTATE WATERS, ST. LAWRENCE REGION,
SUMMARY [a]

Priority [b]	New York		Vermont		Total	
	No.	Pop. [c]	No.	Pop. [c]	No.	Pop. [c]
Municipal, Institutional and Federal						
I	-	-	2	2,700	2	2,700
II	1	400	13	29,500	14	29,900
III	3	3,700	13	28,100	16	31,800
IV	1	6,900	8	8,600	9	15,500
	5	11,000	36	68,900	41	79,850
Industrial						
I	-	-	1	300	1	300
II	-	-	4	500	4	500
III	-	-	2	300	2	300
IV	-	-	-	-	-	-
	-	-	7	1,100	7	1,100
Total						
I	-	-	3	3,000	3	3,000
II	1	400	17	30,000	19	30,400
III	3	3,700	15	28,400	18	32,100
IV	1	6,900	8	8,600	9	15,500
	5	11,000	43	70,000	48	81,000 [d]

[a] See Tables III-10 and III-11 for listing of individual sources.

[b] See Appendix A for Priority Criteria.

[c] Population served for municipal sources; population for industrial sources based upon population equivalents determined on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD per day.

[d] Total of known population served and calculated population equivalents.

TABLE III-10

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTRASTATE WATERS, ST. LAWRENCE REGION
NEW YORK STATE

Waste Source	Construction Activity Code [a]	Population Served (000)
	Priority I [b]	
None		
	Priority II [b]	
A. Municipal		
Bloomingdale	01	0.4
		0.4
B. Industrial		
None		
	Priority III [b]	
A. Municipal		
Bangor	01	0.2
Lake Placid	02	3.0
Ausable Forks	01	0.5
		3.7
B. Industrial		
None		
	Priority IV [b]	
A. Municipal		
Saranac Lake	02	6.9
		6.9
B. Industrial		
None		
	TOTAL	11.0 [c]

a/ See Tables III-13 and III-14 for definitions of Construction Activity Codes.

b/ See Appendix A for priority criteria.

c/ Total of known population served.

TABLE III-11

IMMEDIATE CONSTRUCTION NEEDS BY PRIORITY
INTRASTATE WATERS, ST. LAWRENCE REGION,
VERMONT

Waste Source	Construction Activity Code [a]	Population Served (000) [b]
Priority I [c]		
A. Municipal		
Hardwick	01	1.5
Barton	01	1.2
		2.7
B. Industrial		
E. S. Reed & Sons, Fairfield	A	0.3
		3.0
Priority II [c]		
A. Municipal		
Orleans	01	1.0
Wallingford	01	0.3
Center Rutland	01	0.1
West Rutland	01	2.0
Pittsford	01	0.8
East Barre	02	2.5
Williamstown	01	0.3
Barre	04	10.4
Montpelier	04	8.6
Waterbury	01	1.9
Stowe	01	0.5
Morrisville	01	1.0
Hinesburg	01	0.1
		29.5
B. Industrial		
C. Economou Cheese, Hinesburg	A	0.3
White Pigment, S. Wallingford	C	na
Valley View Creamery, E. Wallingford	B	0.2
Eastern Magnesia Talc, Johnson	C	na
		0.5
		30.0

TABLE III-11 (Cont'd)

Waste Source	Construction Activity Code [a]	Population Served (000) [b]
Priority III [c]		
A. Municipal		
Richmond	01	0.2
Rutland	04	19.0
Proctor	04	2.0
Brandon	04	2.4
Bristol	01	0.5
Cabot	01	0.2
Marshfield	01	0.2
Plainfield	01	0.5
Hyde Park	01	0.3
Johnson	01	0.7
Milton	01	0.8
Derby Center	01	0.4
Derby Line	01	0.9
		28.1
B. Industrial		
Milton Co-op Dairy, Milton	A	0.2
Richmond Co-op, Richmond	A	0.1
		0.3
		28.4
Priority IV [c]		
A. Municipal and Institutional		
Essextown	02	0.7
Middlebury	02	3.4
Queens City Park	02	0.2
Waterbury Hospital	04	3.5
State Ski Dorm, Stowe	05	na
Mt. Mansfield	05	na
Island Pond	01	0.6
		8.4
B. Industrial		
None		
C. Federal		
Ripton (Job Corps Center)	05	0.2
		0.2
		8.6
	TOTAL	70.0 [d]

a/ See Tables III-13 and III-14 for definitions of Construction Activity Codes.
b/ Population served for industrial sources based upon population equivalents determined on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD per day.
c/ See Appendix A for priority criteria.
d/ Total of known population served and calculated population equivalents.
na Data not available.

TABLE III-12

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTRASTATE WATERS, ST. LAWRENCE REGION,
SUMMARY [a]

Construction Activity Code [b]	New York		Vermont		Total	
	No.	Pop. [c]	No.	Pop. [c]	No.	Pop. [c]
Municipal and Federal						
01	3	1,100	23	16,000	26	17,100
02	2	9,900	4	6,800	6	16,700
04	-	-	6	45,900	6	45,900
05	-	-	3	200	3	200
	5	11,000	36	68,900	41	79,900
Industrial						
A	-	-	4	900	4	900
B	-	-	1	200	1	200
C	-	-	2	-	2	-
D	-	-	-	-	-	-
	-	-	7	1,100	7	1,100
Totals		11,000		70,000		81,000 [d]

[a] See Tables III-13 and III-14 for individual sources.

[b] See Tables III-13 and III-14 for identification of Construction Activity Code.

[c] Population served for municipal purposes; population equivalent on BOD basis for industrial sources.

[d] Total of known population served and calculated population equivalents.

TABLE III-13

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTRASTATE WATERS, ST. LAWRENCE REGION,
MUNICIPAL NEEDS

Waste Source	Population Served (000)
Code 01: Discharging raw sewage. Build secondary plant.	
New York	
Bloomingdale	0.4
Bangor	0.2
Ausable Forks	0.5
	1.1
Vermont	
Orleans	1.0
Barton	1.2
Hardwick	1.5
Wallingford	0.3
Center Rutland	0.1
W. Rutland	2.0
Pittsford	0.8
Derby Line	0.9
Williamstown	0.3
Waterbury	1.9
Stowe	0.5
Morrisville	1.0
Bristol	0.5
Cabot	0.2
Marshfield	0.2
Plainfield	0.5
Hyde Park	0.3
Johnson	0.7
Island Pond	0.6
Richmond	0.2
Milton	0.8
Derby Center	0.4
Hinesburg	0.1
	16.0
	17.1
Code 02: Not suitable for upgrading to secondary. Build new primary and upgrade to secondary.	
New York	
Lake Placid	3.0
Saranac Lake	6.9
	9.9

TABLE III-13

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTRASTATE WATERS, ST. LAWRENCE REGION,
MUNICIPAL NEEDS (Cont'd)

Waste Source	Population Served (000)
Code 02: Not suitable for upgrading to secondary. Build new primary and upgrade to secondary. (Cont'd)	
Vermont	
East Barre	2.5
Essextown	0.7
Middlebury	3.4
Queens City Park	0.2
	6.8
	16.7
Code 04: Suitable for upgrading. Build new secondary facilities.	
New York	
None	-
Vermont	
Barre	10.4
Montpelier	8.6
Rutland	19.0
Proctor	2.0
Brandon	2.4
Waterbury Hospital (Institutional)	3.5
	45.9
	45.9
Code 05: Intermediate plant suitable for upgrading. Build new secondary facilities.	
New York	
None	-
Vermont	
Ripton Job Corps Center (Federal)	0.2
State Ski Dorm, Stowe	na
Mt. Mansfield	na
	0.2
	0.2
TOTAL	79.9 a/

a/ Total of known population served.

na = data not available.

TABLE III-14

IMMEDIATE CONSTRUCTION NEEDS BY TYPE,
INTRASTATE WATERS, ST. LAWRENCE REGION,
INDUSTRIAL NEEDS

Waste Source	Population Served (000)
Code A: Provide secondary treatment or equivalent, including chlorination.	
New York	
None	
Vermont	
E. S. Reed & Sons, Fairfield	0.3
Milton Co-op Dairy, Milton	0.2
C. Economou Cheese, Hinesburg	0.3
Richmond Co-op, Richmond	0.1
	0.9
	0.9
Code B: Provide secondary treatment or equivalent.	
New York	
None	
Vermont	
Valley View Creamery, E. Wallingford	0.2
	0.2
	0.2
Code C: Provide for segregation and separate treatment of one or more types of waste.	
New York	
None	
Vermont	
White Pigment, S. Wallingford	na
Eastern Magnesia Talc, Johnson	na
Code D: Same as C; with biological treatment for all or part of the waste load including chlorination.	
None	
TOTAL (Codes A - D)	1.1[a/]

a/ Total of calculated population equivalents.
na Data not available.

TABLE III-15

IMMEDIATE CONSTRUCTION COST,
INTRASTATE WATERS, ST. LAWRENCE REGION,
MUNICIPAL NEEDS THROUGH 1990

Priority [a]	No. Plants N.Y.	No. Plants Vt.	Estimated Plant Cost [b] ($000) N.Y.	Estimated Plant Cost [b] ($000) Vt.	Estimated Cost [c] Ancillary Works ($000) N.Y.	Estimated Cost [c] Ancillary Works ($000) Vt.	Total By State ($000) N.Y.	Total By State ($000) Vt.	Total ($000)
I	-	2	-	410	-	340	-	750	750
II	1	13	60	2,380	50	1,970	110	4,350	4,460
III	3	13	370	1,930	310	1,600	680	3,530	4,210
IV	1	8	430	800	360	660	790	1,460	2,250
	5	36	860	5,520	720	4,570	1,580	10,090	11,670
Construction Activity Code [a]									
01	3	23	190	2,540	160	2,100	350	4,640	4,990
02	2	4	670	830	500	690	1,230	1,520	2,750
04	-	6	-	2,120	-	1,750	-	3,870	3,870
05	-	3	-	30	-	30	-	60	60
	5	36	860	5,520	720	4,570	1,580	10,090	11,670

[a] See Table III-13 for Construction Activity Code and Appendix A for priority criteria.

[b] Estimated plant cost = (1966 population served x factor projected to year 1990) x (unit cost per capita) x (projected 1970 FWPCA construction cost index) x (factor for engineering, legal and other fees).

[c] Estimated cost for ancillary work (interceptors, outfalls, pumping stations, etc.) = (Estimated cost of plant) x (.83).

TABLE III-16

IMMEDIATE CONSTRUCTION COSTS,
INTRASTATE WATERS, ST. LAWRENCE REGION,
INDUSTRIAL NEEDS THROUGH 1990

Priority [a]	No. Plants N.Y.	No. Plants Vt.	Estimated Plant Cost ($000) [b] N.Y.	Estimated Plant Cost ($000) [b] Vt.	Estimated Cost Ancillary Work ($000) [c] N.Y.	Estimated Cost Ancillary Work ($000) [c] Vt.	Total By State ($000) N.Y.	Total By State ($000) Vt.	Total ($000)
I	-	1	-	50	-	30	-	80	80
II	-	4	-	120	-	60	-	180	180
III	-	2	-	40	-	20	-	60	60
IV	-	-	-	-	-	-	-	-	-
	-	7	-	210	-	110	-	320	320
Construction Activity Code [a]									
A	-	4	-	140	-	70	-	210	210
B	-	1	-	40	-	20	-	60	60
C	-	2	-	30	-	20	-	50	50
D	-	-	-	-	-	-	-	-	-
	-	7	-	210	-	110	-	320	320

a/ See Appendix A for priority criteria and Table III-14 for Construction Activity Code.

b/ Estimated plant cost = (1966 population equivalents x water use factor projected to year 1990) x (unit cost per capita) x (projected 1970 FWPCA construction cost index) x (factor for engineering and other fees).

c/ Estimated cost for ancillary work (process changes, segregation and collection systems, etc.) = (Estimated cost of plant) x (.50).

IV - OTHER MANAGEMENT AND RESEARCH NEEDS

STREAM SURVEILLANCE PROGRAMS

To effectively accomplish the objectives of a water quality management program designed to protect and enhance prime water usages as established by State authorities, it is necessary that adequate stream surveillance programs be established. Such programs should include a network of manual and automated sampling stations which permit the collection, evaluation and dissemination of water quality data, so as to present a clear picture of conditions in any section of the St. Lawrence Region. These monitoring stations should be strategically situated near major wastewater sources so as to alert pollution control authorities to irresponsible or accidental discharge of harmful material. Hence, appropriate corrective actions can be taken immediately.

A surveillance program for New York State waters was established by the New York State Health Department in 1962. Since its inception, and aided by the Pure Waters Program funds made available in 1966, the New York program has developed an elaborate network of manual and automated sampling stations.

Vermont has yet to develop an effective surveillance program. There is an immediate need for the State to establish a system of manual and automated sampling and monitoring stations.

STORAGE AND STREAM FLOW REGULATION

The total usable storage capacity of water resource developments in the St. Lawrence Region amounts to approximately 300,000 acre-ft., nearly all of which is used by existing hydroelectric power plants that are maintained and operated by either public utilities or private industry.

In general, this storage is not available for the augmentation of stream flow during critical low flow periods. In addition, many of the structures are operated for peak power only, with no flow other than leakage allowed through the dam during non-generating periods. As a result, downstream flows are seriously limited at times. There is a need to balance all water resource demands to provide adequate flow and quality in the streams.

Comprehensive basin-wide studies are needed to establish sound plans designed to permit such a balance between other beneficial water uses and power development. Such studies should determine the minimum flows required to provide adequate water supply, meet irrigation needs, effect pollution control and enhance recreational development. Follow-

ing these determinations, plans should be developed to coordinate flow releases so as to meet these needs.

OPERATION AND MAINTENANCE

An adequate program of operation and maintenance at waste treatment plants is necessary to ensure that the existing and recommended new municipal and industrial treatment facilities will be effective in maintaining adequate water quality.

Adequate operation of treatment plants requires qualified resident personnel, proper laboratory control, and accurate record keeping. State, interstate and Federal agencies must provide programs aimed at ensuring these three factors are included at each plant.

Because of the limited supply of qualified operating personnel, there is an urgent need for both long and short term training courses in treatment plant operation. Such training should be continuous, and should lead to state licensing of operators.

Federal grants to aid the states in meeting their responsibility for the training of qualified personnel should be considered. Federally sponsored and conducted training programs should also be established to assist in the training of personnel.

In order to ensure the successful implementation of any operation and maintenance program, the states must have a sufficient number of trained inspectors to periodically visit plants to review operation and laboratory control methods, and to provide technical assistance to plant personnel.

In recent years, New York State has taken positive action to upgrade plant performance by improving operation and maintenance. Legislation enacted in 1964 established a fund which provides for the payment to municipalities of one-third the cost of operation and maintenance of adequate treatment plants. To qualify, municipalities must have standard operating reports which show performance and laboratory test data, a qualified operator in charge of the plant and the collection and conveyance system must minimize the amount of untreated waste discharged.

Vermont has no legal requirements governing plant operation and maintenance. In 1960 the state legislature instituted an inspection program, but this requires only a once yearly inspection of plants within the State. There is no legal requirement for licensing of plant operators, although operators are urged to become certified by the New England Water Pollution Control Federation.

SPECIAL STUDIES AND SURVEYS

Municipal and Industrial Waste Inventory

A review of the available data on location, volumes and characteristics of existing municipal and industrial waste discharges within the region indicates the need for more adequate information. The information contained in this report should be validated, in many cases requiring field surveys. In addition, once an adequate base inventory has been established, there is a need to maintain the data current. The states should develop adequate records providing the latest information on all waste loads for use in planning, and determination of further pollution abatement needs.

Septic Tank Survey

Within the St. Lawrence Region there are an estimated 300,000 persons who dispose of domestic wastes by individual septic tanks or cesspools. There are no adequate data indicating the pollutional effects of such systems. Studies should be conducted to determine the following:

1. Location of those areas with large numbers of septic tank systems.

2. Determination of the effects such systems have on surface and groundwater.

3. A plan for eliminating inadequate individual disposal systems by connection to existing or new municipal collection systems. Planning of such systems should be based on regional, inter-county and inter-municipal areas.

While the first two items could be accomplished by the Federal Water Pollution Control Administration in cooperation with State and Federal agencies, the third item is the responsibility of State and local government. Existing Federal grant programs could be used to accelerate the planning, design, and construction of such regional collection systems.

Thermal Pollution

With the growth in thermonuclear power plants and continuing increase in industrial cooling water usage, pollution of these waters by heat may become a critical problem. All existing sources of thermal pollution should be identified and determinations made of their effects on the aquatic environment. Plans for new facilities should include provision for cooling towers or other means to prevent discharge of heated wastes.

Stormwater Overflow and Urban Runoff

Within the St. Lawrence Region there are 33 municipal sewerage systems that have, at least in part, combined storm and sanitary sewage collection. There is a need to determine the quality and quantity of overflows from such systems, the extent to which such overflows degrade water quality, and similarly, the magnitude and effects of urban runoff directly to the receiving waters.

Boat Pollution

There is a need to determine the magnitude of the problem associated with the discharge of litter, sewage, and oil from the large numbers of watercraft in the region. Investigations should include research to develop practical means of controlling this source, surveys to determine the need for adequate disposal facilities at marinas, and a determination of adequate legislation to control such pollution. The State of New York has recently enacted and implemented appropriate legislation governing the discharge of wastes from vessels. Vermont has no specific legislation. Assuming the development of adequate legislation and satisfactory control devices, there will be a need for extensive enforcement activity on such large lakes as Lake Champlain to ensure control of this source.

Agricultural Runoff

There are no data available to indicate the extent of water pollution attributable to agricultural runoff. Since runoff from cultivated fields may convey fertilizers, herbicides and pesticides to the receiving waters, the potential dangers of such pollution require a thorough investigation. Such a study should include a determination of the types and amounts of agricultural chemicals being used, analytical data to measure the concentration of these chemicals in the receiving streams, and research into allowable concentrations and adequate control measures.

Survey of Camping Facilities

Since there are no data to determine the effects of wastes from the increasing number of camping sites, a survey should be made to determine the number and location of such sites, the type of treatment facilities provided, and the magnitude of water quality problems attributable to this source.

Water Quality Studies

The data included in Section VI indicate the extent to which existing water quality data are inadequate. Necessary field and laboratory sampling and analyses must be conducted to provide adequate

data on existing water quality. Such information will not only confirm suspected problem areas and locate those areas with problems as yet unknown, but will establish a base against which future changes in water quality can be measured.

Aquatic Plants and Nutrients

Many areas within the St. Lawrence Region are plagued by dense growths of aquatic weeds and algae to the extent that interference with beneficial water use results. There is a need for a survey to determine the extent and location of such plant growths, the determination of contributing causes and the development of programs to control the problem. Such control programs should include reduction in the quantities of nutrient materials discharged to the waters as well as means of physical removal of dense plant growths.

Advanced Waste Treatment

Greater emphasis should be placed on the application of advanced waste treatment techniques, particularly in those areas where the receiving waters have insufficient assimilative capacity to handle the effluent of secondary waste treatment facilities. The application of such advanced treatment techniques should be considered for both municipal and industrial wastes.

Hydrodynamic Studies

Pollution control in Lake Champlain is complicated by the lack of knowledge of such factors as currents, disperson of pollutants, and stratification. Although some studies are underway by the University of Vermont, there is a need for better coordination of existing studies and a more comprehensive approach to obtain an adequate understanding of the problems associated with a lake the size of Lake Champlain.

Data Systems

With the increasing tempo of data collection by a number of agencies at all levels of government, there is a need for an integrated system of handling water quality and water use data within the region. Such a system, which might be based on the existing Federal Water Pollution Control Administration STORET program, would make possible better interchange of knowledge and eliminate duplication of studies. Such an integrated system would also be of great value in permitting the application of such techniques as mathematical modelling and systems analysis in the development of overall water quality management programs.

Regional Cooperation

A review of water quality problems and water needs within the St. Lawrence Region points out their interrelationship throughout the entire area. There is a need for close coordination and water quality management to ensure that on-going and future programs consider not only the immediate locality but also the effects upon the region as a whole.

Before comprehensive water management programs can be formulated, studies must be carried out to determine the appropriate legislative and institutional responsibilities needed to integrate planning programs for major river drainage basins. Studies recommending the creation of regional authorities must ensure that the needs of the smaller river basins are represented, weighed and/or integrated into the regional water management programs.

Legal Framework

To ensure that adequate water pollution control programs can be formulated and implemented, there is a need to evaluate existing legal mechanisms and institutional arrangements to determine their adequacy to deal with water quality problems on both local and a regional basis. At the present time there is a lack of data on the adequacy of existing framework, as well as a lack of information on the interrelationships between various authorities and governmental agencies in dealing with the problem of resource management. In a number of localities there is a requirement for additional legislation to zone present and future lake shoreline developments.

Financial Arrangements

Investigations must be carried out to determine the amount of financial participation each basin entity (government and private) should produce to meet expenditures required for immediate and long range pollution control programs. The role of Federal, State, local and private bodies must be evaluated in terms of cost and benefits to give an indication of the economic impact of water pollution control programs and their effects upon the Region as a whole. Such problems as competition between various public works programs such as highways, education, and water pollution control must be evaluated to ensure that programs aimed at achieving water quality management receive a proportionate share of total public and private expenditures.

Miscellaneous Studies

In addition to the outline of studies listed above there is a need to survey a variety of other existing pollutional sources and potential problem areas including oil pollution sources.

V. RECENT PROGRESS IN POLLUTION CONTROL

INTERSTATE ACTION

Both New York and Vermont are signatory members of the New England Interstate Water Pollution Control Commission. The portions of the St. Lawrence Region which are under the jurisdiction of the New England Interstate Water Pollution Control Commission are the Lake Champlain and Lake Memphremagog drainage basins. The New England Commission serves as a coordinating body for the adoption of stream classification programs by member states, and to further the technical aspects of water pollution control through exchange of information by the Technical Advisory Board as well as through the mechanism of research contracts. Of particular note with respect to this latter operation are research studies on the problems of textile wastes done under contract with the Commission. New York State's role in the Commission is limited to waters shared jointly by New York and the New England States, i.e., Lake Champlain.

A quasi-official interstate body, INCOCHAMP (Interstate Commission on the Champlain Basin) has operated in the past to bring together resource management personnel from New York and Vermont, in an attempt to plan orderly development of the land and water resources of the Champlain basin. Although no official compact was created to authorize this agency, both states have had tentative statutory approval to create the Lake Champlain Basin Compact. Once established, this compact will serve as a formal planning authority charged with the responsibility of planning land and water resources within the basin including such activities as water pollution control. There is a possibility that this compact once established may be expanded to include the United States as a party in that aspect of the compact relating to water resources management.

VERMONT

Since the enactment of enabling legislation in 1949, the State of Vermont has carried out its water pollution control program through the State Water Resources Board and the staff of the State Department of Water Resources. As a New England Interstate Water Pollution Control Commission member, Vermont adopted a classification program to assure best future water use for each stream together with treatment requirements to permit such use. This program has yet to be completed.

Recent legislation in Vermont has increased the state construction grants from 20 to 30 percent of the cost of municipal waste facilities. Vermont has also instituted a program of incentive grants to provide additional funds beyond those authorized by the conventional state construction grants for those municipalities with a limited economic base which are required to construct waste treatment facilities by

the Vermont Water Resources Board. To speed up the classification program, the legislature enacted a law providing that after January 1, 1969, all waters in the state shall be at least Class "C" quality, unless a permit is granted by the Water Resources Board allowing a lesser quality. (Class C waters are defined as suitable for fish and wildlife habitat; recreational boating, and industrial processes and cooling; under some conditions, acceptable for public water supply with appropriate treatment; good aesthetic value).

State law requires the Department of Water Resources to inspect each municipal treatment plant at least annually, but there are no requirements for licensing of treatment plant operators. Voluntary registration through the New England Water Pollution Control Association is urged by the department but there is a need for state legislation requiring official certification and licensing by the State of treatment plant operators.

Stream surveillance work in Vermont has been limited to studies necessary for the adoption of stream classification and on an annual basis at selected lakes and ponds. There is a need for additional funds and manpower to increase the surveillance program so as to ensure compliance with classifications, once adopted.

NEW YORK

In 1965, the State of New York completed a comprehensive survey of its pollution abatement needs. This initial survey showed that more than 100 municipalities provided no treatment, and an additional 43 communities provided inadequate treatment. It also indicated that the control of industrial wastes was the most challenging pollution problem in the State.

In August 1965, the State Health Department adopted new treatment requirements which prescribe minimum treatment levels for each class of water. The policy also requires that wastes must be treated on the basis of the highest downstream classification and not merely the classification of the immediate receiving water. Under this policy treated wastes must meet the following requirements:

Classification	Minimum Required Treatment
AA	Tertiary treatment and chlorination
A & B	Secondary treatment and chlorination
C	Secondary treatment
D	Primary treatment, secondary treatment where these waters adversely affect downstream waters of higher classification.

In November of 1965, New York State enacted a Pure Waters Act with an accompanying 1.7 billion dollar program for water pollution control. The principal features of this Act include:

1. A one billion dollar fund to pre-finance Federal construction grant money so as to make possible total State and Federal grants of 60% of the cost of treatment plants, outfalls and interceptors.

2. Tax incentives to increase pollution control activities by industry.

3. Payment of one-third of the operation and maintenance costs of municipal plants providing adequate treatment.

4. Establishment of an automated water quality monitoring network throughout the State.

5. Provision for accelerated enforcement procedures.

6. Establishment of a program to control waste discharges from State installations.

7. Promotion of basic and applied research.

During the 1966 legislative session the State passed additional statutes to further the water pollution control program. These new laws included the following provisions:

1. Municipalities under orders by the State Health Department are denied the right of referendum on bond issues for the construction of treatment facilities.

2. Cities are permitted to anticipate future waste control needs in the purchase of land and in the construction of treatment plants, to provide capacity for future growth.

3. Bacteriological standards were set for waters used for potable water supply and bathing and for streams that traverse urbanized areas. This statute requires higher treatment efficiencies when coliform counts in the receiving water reach specified maxima.

4. Local authorities were given enforcement power to abate wastes from individual homes and small businesses.

5. Regulations were established to control pollutional discharges from boating.

6. Both municipalities and industries must maintain records on the quantity and quality of waste discharges and must make these records available to the Commissioner of Health. This law also prohibited the use of any existing or new outlet for waste discharge unless such use complies with all rules and regulations of the State Health Department.

7. An authorization for injunctive action when a violation of water pollution control law occurs.

8. Local financing laws were liberalized to encourage greater local initiative in construction of waste treatment facilities.

FEDERAL

Federal Water Pollution Control Administration resources have been employed in a number of instances to investigate and abate pollution in the St. Lawrence Region. In addition to the activity of the construction grants program a number of laboratory and field studies have been undertaken. In 1965 a Federal Water Pollution Control Administration report entitled "Water Quality Control Study--Champlain Waterway, New York and Vermont" was completed for the U. S. Army Corps of Engineers. This report examined the existing Lake Champlain Waterway and reviewed the effects of proposed changes in the size of the channel. The report covered water quality effects as related to present and future water needs. In 1966 Federal Water Pollution Control Administration personnel undertook a cooperative study with the States of New York and Vermont to determine the effects of waste discharge from the International Paper Company and the Village of Ticonderoga, New York, on water quality in Lake Champlain. In addition, limited biological, microbiological, and chemical analyses have been performed on a number of the streams within the St. Lawrence Region.

On-going studies by the Corps of Engineers including the North Atlantic Regional Framework Study and the Northeast Water Supply Study are aimed at providing broad based survey data on both present and future water resource problems within the St. Lawrence Region. Both of these studies involve a number of Federal agencies, as well as the water pollution control and water resource agencies of New York and Vermont.

VI - BACKGROUND FOR RECOMMENDATIONS

KNOWN WATER QUALITY PROBLEM AREAS

To determine the extent that municipal, industrial and other waste discharges have affected the quality and use of the St. Lawrence waters, an evaluation was made, based on existing data from limited Project field surveys, New York and Vermont State reports and records, and from the New England-New York Inter-Agency Committee Report. Analytical data were compared with parameter values regarded as acceptable for such water uses as water supply, recreational bathing and boating, and sport fishing. The following streams and water bodies, arranged by river basin, were found to have water quality below that required for the expected water uses. Specific problems and those areas requiring further study are also indicated.

St. Regis River Basin

Nine known municipal waste sources are discharging into five streams in this basin. These streams are the St. Regis River, Salmon River, Little Salmon River (a tributary), Chateaugay River and Marble River (a tributary). Field surveys must be carried out to develop data to determine the extent to which these waters are being altered or adversely affected. There are no data of any type on five other streams which cross the international boundary. These are Pike Creek, Trout Creek, Collins Brook (a tributary), Oak Creek and English River.

Lake Champlain Basin

Mettawee River

The Mettawee River has high coliform bacteria counts, and the biota appears to have been adversely affected by pollution. Raw sewage, including floating fecal matter, has been observed by Project personnel in many places on the river. Suspected sources are the primary treatment plant at Granville, which has no chlorination facilities, and the raw waste discharges at Whitehall. There are several other towns, and many individual housing units, serviced by septic tank systems which may also contribute to the degradation of these waters.

Champlain Canal

Available data indicate that the Champlain Canal is polluted by municipal waste discharges. Two plants, located along the canal, which may be the principal causes of pollution are the outdated Fort Ann primary plant and the secondary treatment facility of Great Meadow

Prison at Comstock. Further studies are needed to determine to what extent each of these facilities affect water quality of the canal. Flow regulation practices, commercial and recreational boating activities and other unknown waste sources may also be contributing to the degradation of the canal waters. Further studies in these areas are required.

Lake Champlain

Water quality in Lake Champlain is generally satisfactory for all existing uses, although the narrow part of the Lake (southern end) and those shoreline areas, such as restricted bays, which are subject to the direct discharges of inadequately treated wastes, do have serious pollution problems. Other localized problems are found where tributary streams with poor water quality enter the Lake.

Existing data compiled from State and Project records indicate the areas of poor water quality include, in New York, Rouses Point, Cumberland Bay, Port Kent, Willsboro, Port Henry and Ticonderoga, while in Vermont, Malletts Bay, St. Albans Bay, and Burlington Harbor are major problem areas. Low dissolved oxygen concentrations and high coliform densities have been found in these areas. The high turbidity in the southern portion of the Lake prevents the use of this area for fishing. Algae and other aquatic growths are a common problem. In St. Albans Bay, for example, dense weed and algal growths restrict the recreational use of the water. There are a number of municipal, industrial and other sources of waste discharged to the Lake. The existing hydrographic conditions combined with natural and man-made eutrophication compound problems in the area. Further studies will be required to define these effects, and to consider the effects of proposed changes in the pattern of Lake usage. For example, the proposed use of the Lake for commercial navigation by construction of a deep waterway should be evaluated in terms of the effects on continued recreational development.

Ticonderoga Creek

The water quality of Ticonderoga Creek is poor, due to the discharge of untreated waste from the International Paper Company, which has an estimated BOD equivalent of 316,000 persons, and raw municipal sewage from Ticonderoga Village.

Little Ausable River

The Little Ausable River is characterized by high coliform densities and high BOD values. The obsolete and overloaded primary treatment plant at Peru, New York is a known source of pollution of this stream.

Ausable River

The Ausable River is polluted by municipal and industrial wastes, including two municipal sources and one industrial facility. Additional field work is necessary to determine to what extent each of these facilities contributes to the pollution.

Behan Brook

Based on limited data, Behan Brook is presently polluted by inadequately treated municipal wastes. Additional studies must be made to identify other pollution sources.

Great Chazy River

Limited data indicate this river is polluted by the discharge of primary treated municipal sewage from Champlain as well as untreated waste from the Champlain Creamery Company. Further data are needed to evaluate the full effect of these sources.

Little Chazy River

The Little Chazy River is polluted by the raw and unchlorinated municipal discharge of Chazy Town. Additional work is needed to determine to what extent this discharge is affecting these waters.

Bouquet River

Limited data indicate that the water quality of the Bouquet River is degraded by the discharge of untreated municipal wastes. Additional study is necessary to determine to what extent the raw discharges of Willsboro Town affect these waters.

Saranac River

Of the municipal and industrial waste discharges to the Saranac River and its tributaries, the largest are from the primary plant at Plattsburgh and the outdated primary plant at Clinton Prison Hospital. Additional work is needed to identify the extent to which each of these sources contribute to water degradation.

Mill Brook

Available data indicate pollution by municipal and industrial wastewater discharges, but further investigation must be performed to determine to what extent the existing two municipal primary plants and one industrial installation are degrading these waters.

Castleton River

The recorded high coliform densities and low dissolved oxygen levels indicate that the water quality of the Castleton River is poor. The major contributors appear to be the obsolete primary treatment plant at Castleton and the raw sewage discharge from Fair Haven. Other contributing factors that may be affecting water quality are low flows, septic tank seepage and the reported discharges of nine industrial firms. Fair Haven Mills, one of these industries, may be releasing toxic chemicals into these waters. Further information is needed on these factors.

Poultney River

The Poultney River can be described as polluted. High coliform densities, low dissolved oxygen levels and high BOD concentrations have been recorded over the entire length of river. High turbidity has also been found in the mountainous head waters. The discharge of raw sewage from the Town of Poultney and the entry of polluted waters from the Castleton River, a major tributary, are considered the major sources of pollution. Industrial waste discharges and septic tank seepage are also suspected as causing poor water quality. Low flow conditions which occur during the summer months result in further degradation. The cause of the high turbidity in the upper reaches is not known, and additional sampling and analytical work of the total Poultney River drainage basin is needed.

Otter Creek and its Tributaries

There are 13 municipal and eight industrial facilities known to be discharging into the Otter Creek and its tributaries. These waste discharges result in high turbidity, high bacterial counts, low dissolved oxygen levels and high BOD values. The untreated waste discharges at Wallingford, Center Rutland, West Rutland, Pittsford and Bristol appear to be major contributors to the poor water quality of these waters, but other sources may include septic tank discharges and the eight industrial installations releasing process wastes into these waters. Low stream flows during the critical summer months further complicate the problem. Additional investigation is needed to determine the significance of each of these factors.

Missisquoi River and Bay

Data indicate that the Missisquoi River is polluted by the discharge of inadequately treated municipal and industrial wastes. High coliform counts and BOD levels, and low dissolved oxygen values have been recorded throughout the river. Major sources appear to be the discharge of raw sewage from North Troy, Richford, Enosburg Falls,

Montgomery Center, and Swanton, but septic tank discharges and the wastes from eleven industrial installations may be contributing factors. Further study is needed to determine the extent of pollution by these sources.

Limited information gathered during an FWPCA screening program in 1966 indicates that water quality of Missisquoi Bay is generally good, although further data are needed to determine the effects of the River upon the Bay.

Lamoille River and its Tributaries

The water quality of the Lamoille River is characterized by high coliform counts, high BOD, low dissolved oxygen concentrations and high turbidity. The discharges of raw sewage from Morrisville, Johnson, Fairfax, and Milton are the major known sources of pollution. High temperatures and high pH levels have been observed on several tributary streams. Additional studies are needed to determine the cause of these elevated temperatures and high pH levels.

There is also evidence of high coliform densities in the Gihon River, a major tributary to the Lamoille. Possible causes are raw sewage from Hyde Park, septic tanks, agricultural or industrial discharges, but further data are needed to determine the effects of these sources.

Flow in the Lamoille River is regulated by extensive hydroelectric development. The reduction of flows by these dams to below that flow needed to handle the imposed waste is a problem which needs further study.

La Platte River

Water quality in the La Platte River is degraded seriously by municipal and industrial waste discharges. Available data indicate extremely high levels of turbidity, BOD and coliform with severely depressed dissolved oxygen, including septicity. There is also some indication of thermal pollution. The raw discharges of the communities of Shelbourne and Hinesburg and the C. Economou Cheese Co. are suspected causes of the bacteria, turbidity and oxygen problems, but no data are available to indicate the source of thermal pollution.

Winooski River

Data indicate poor water quality in the Winooski River, evidenced by high coliform counts, high BOD values, low dissolved oxygen levels and high pH values. Water quality is particularly bad near the confluence of the Winooski River with Lake Champlain, primarily the result of the raw discharges from seven municipal collection systems

and the primary facilities at South Burlington (main plant), Burlington (main plant) and Essex Town (Ethan Allen). The primary plant at Montpelier also contributes to present conditions. In addition, there are five other primary treatment plants discharging to the Winooski or its tributaries. Although these plants are in a satisfactory condition, they affect water quality of the Winooski River. Septic tank discharges from the many small communities and individual housing units located along the river are also suspected of poor water quality. These sources of pollution need further investigation.

An additional problem on the Winooski River is the extensive flow regulation by hydroelectric power dams. Further studies are needed to determine minimum flow requirements and the overall effects of such regulation.

Many of the streams tributary to the Winooski River have poor water quality, as shown by high coliform densities and low dissolved oxygen levels. The outdated primary plant at East Barre, and the primary plant at Barre City are considered causes of pollution of Stevens Branch, the major tributary to the Winooski, but septic tank discharges and industrial wastes may also be significant factors. An investigation should be made of these suspected areas of pollution.

Lake Memphremagog Basin

Lake Memphremagog

In general, the water quality of Lake Memphremagog is good, but there may be localized water quality problems caused by the in-flows from the polluted Barton and Clyde Rivers. There is also a potential pollution problem from the increasing use of the lake for recreational boating. Additional field and analytical work must be performed to determine the extent of pollution of the lake by these sources.

Clyde and Barton Rivers

Both the Clyde and Barton Rivers have pollution problems, as indicated by high coliform counts, low dissolved oxygen and high BOD levels. The major sources of pollution are the raw discharges from six municipalities, but there are two known industrial waste sources which also affect these streams.

STREAM CATEGORIZATION

To highlight the extent of existing information on present water quality of the various streams, inlets and bays within the study area, a system of categorization was used, that summarizes existing data. This system assigns to each water body one or more of the following

categories:

Category I	-	No water quality problems;
Category II	-	Water quality problems are known and solutions readily identified;
Category III	-	Water quality problems are indicated by available data, but causes and/or solutions are unknown;
Category IV	-	Insufficient data to indicate presence or absence of problems.

The categories assigned to the streams and lakes, as shown in Table VI-1, point out that little or no information is available as to the extent of pollution other than that from certain municipal and industrial waste discharges. Where available data indicate a need for increased treatment at existing plants, or for construction of new facilities, a Category II was assigned. In many cases, however, lack of information on other sources of pollution, or the seriousness of the problem, resulted in the additional assignment of Category III and/or IV.

Table VI-1 also indicates suspected sources and problems for the various streams. These data, which are based on limited analytical work, combined with knowledge of the particular water body, indicate a need for further studies to determine the extent and control of such pollutional problems as:

1. Pollution from recreational and commercial boating;
2. Septic tanks and cesspools;
3. Natural and man-caused eutrophication of lakes;
4. Circulation and hydrography of lakes;
5. Thermal pollution;
6. Stormwater overflows;
7. Stream flow regulation; and
8. Agricultural drainage.

Since the categories have been assigned on the basis of present knowledge and conditions, continued surveillance should be undertaken to permit identification of new problems as they arise.

MUNICIPAL & INDUSTRIAL POLLUTION SOURCES

The data on which this section is based were obtained from the FWPCA Municipal Waste Inventory of 1962, Project records and inventories maintained by the States of New York and Vermont. It should be emphasized that due to a lack of complete information from these sources, it was necessary to make assumptions for some of the municipal waste sources and for many of the industrial waste discharges.

Based on these data, there are 98 municipal, two federal, and 65 industrial sources discharging wastes into the inter- and intrastate waters of the St. Lawrence Region. Of the 165 sources, 117 provide less than adequate secondary treatment.

Table VI-2 summarizes the distribution of waste sources in the St. Lawrence Region by state and type, and indicates the estimated population served for municipal, institutional and federal wastes and the population equivalent of industrial wastes calculated on a BOD basis.

There are 53 known municipal, institutional and federal waste facilities listed in Table VI-2, which handle the waste load of approximately 60 percent of the total sewered population; and which either discharge directly into interstate waters or into such intrastate waters as to affect the quality of interstate waters. Thirty-nine of the plants are located in New York, serving the needs of approximately 79,000 persons. Vermont has 29 plants, which treat the wastes of 84,000 persons. There are a total of 41 industrial operations discharging wastes into all waters of the Region. These operations include pulp and paper production, milk and dairy processing, stone cutting and finishing, slaughtering, light manufacturing operations and ore and metal processing. All but nine of the industries are located in New York State. Of the 41 sources, 19 were determined to be insignificant pollution problems. The remaining 22 industries are major sources of pollution, discharging a waste load of nearly four times the municipal load requiring abatement. The pulp and paper industries account for nearly all of this loading.

Table VI-2 also shows the number of municipal, Federal institutional and industrial waste sources discharging to intrastate waters in the Region. Of the 47 municipal facilities, 39 serving approximately 71,000 persons are in Vermont, while only eight handling 32,000 are in New York. Twenty-four industries discharge wastes equivalent to only 2,000 persons. All of these facilities are located in Vermont.

OTHER POLLUTION SOURCES

In addition to the pollution by municipal and industrial wastes, there are a variety of other activities in the St. Lawrence Region which have an effect upon water quality. While such problems as recreational and commercial navigation, septic tanks and cesspools, stormwater overflows, and flow regulation are known to exist in the region, very limited data are available to indicate the locations of sources or the extent of the effects upon receiving waters. The following discussions point out the nature of suspected problems associated with these activities.

Recreational and Commercial Navigation

Both recreational and commercial navigation are important water uses throughout the St. Lawrence Region, particularly on the major lakes. Recreational boating can constitute a significant source of pollution as a result of the discharge of human fecal matter, litter, motor exhaust and oil. The discharge of untreated human feces from the many boats in the region represents a significant health hazard, which is particularly acute in crowded marinas where people virtually live aboard ships. The State of New York has recently established regulations governing the disposal of wastewater from watercraft, but the State of Vermont does not have such regulations. Because of the lack of regulations and enforcement, treatment devices such as macerator-chlorinators, incinerator toilets, and holding tanks are not generally in use. In the case of holding tanks, there is a lack of adequate shoreside facilities to receive and treat the waste.

The rapid growth of pleasure boating has resulted in an appreciable increase in dumping of litter, including such materials as plastic food wrap, and glass, metal and cardboard containers. These materials do not readily disintegrate. Some may float onto the shoreline, resulting in the deterioration of the aesthetic quality of the environment.

The exhaust from outboard and certain inboard motors is discharged directly into the water, resulting in contamination of the water by hydrocarbon residues. In restricted waters, such as the numerous coves and bays found along the shores of Lake Champlain and Lake Memphremagog, the concentration of these chemicals could increase to levels detrimental to aquatic life.

Oil pollution can occur as the result of careless operation of recreational boats, but due to the volume of oil involved this phase of the problem is usually limited to those areas where large numbers of boats are concentrated, such as marinas. Of much greater significance is the problem of oil pollution by commercial navigation.

The discharge of oil by commercial traffic may be the result of bilge pumping or physical damage to a tanker or barge, as well as spillages which can occur during ship to shore transfer. At the present time, because of the shallow commercial waterway, this problem is confined to terminal facilities in Lake Champlain, including Port Henry and Westport, New York and St. Albans, Vermont.

The prospect of oil pollution of Lake Champlain by increased commercial traffic has been a major argument by opponents of a proposed deep-channel Lake Champlain Waterway. Present navigation is

restricted to vessels with draft less than 12 feet, while the proposed waterway would handle ocean going vessels. The basic conflict between recreation and commercial use of the Lake has resulted in the creation of large citizens groups to oppose any such increase in commercial traffic.

Septic Tanks and Cesspools

Within the St. Lawrence Region, there are 300,000 persons in 80,000 housing units, as well as an unknown number of business establishments that dispose of domestic waste by individual septic tanks or cesspools. These individual systems, equally distributed in New York and Vermont, serve 68 percent of the 1960 population for the area, twice the population served by municipal collection systems. When the overflow from septic tanks is discharged directly into surface waters, significant bacterial pollution results. Such conditions are particularly evident in the State of Vermont, where many miles of streams have been contaminated by such practices, restricting the use of the water for bathing and other recreational activities.

In non-porous soils, tile fields often fail to handle septic tank overflows in a satisfactory manner, resulting in the overflow of effluent in backyards, streets and finally as surface runoff. Percolation of septic tank effluent into shallow ground water aquifers, which eventually discharge into springs, streams or lakes, adds pollutional material to these surface waters. Under proper geological conditions, deep aquifers can also become polluted by wastes from inadequate domestic disposal systems. Such contamination can produce public health problems in those areas where the ground water is developed for individual and municipal water supplies.

In addition to bacteria there are other substances which are ineffectively treated by cesspools and septic tanks and which have been found entering sub-surface aquifers. Although specific information on ground water pollution by such material is not at present readily available for the St. Lawrence Region, experience in other areas such as Long Island, New York, indicate that this problem can be extremely serious. To prevent such problems will require detailed investigations of the extent and location of individual waste disposal systems as well as the geology of the underlying soil.

Eutrophication and Aquatic Vegetation

There are certain waters in the St. Lawrence Region that are sufficiently rich in both phosphorus and nitrogen to support prolific growths of aquatic weeds and algae. Such growths can interfere with pleasure boating, bathing and other recreational water use.

The major sources of nutrients are the discharges of raw and treated municipal wastes. Other sources, the significance of which are not known, include the overflow or percolation from individual septic tank systems, direct discharges from industry and boats, and runoff from agricultural areas. The problem is complicated by restricted water movement and shallow water depths in many of the coves, lakes and bays in the area. There are very limited data available on the extent of this problem, its causes and the control measures that could prevent further deterrence to water use.

Stormwater Runoff

There are 33 municipal sewerage systems in the St. Lawrence Region that have, at least in part, combined stormwater - sanitary sewage collection. These systems serve over 150,000 persons or nearly two-thirds of the entire sewered population. During storm periods, the overflows from these systems can represent a significant source of pollution. In addition to the discharge of untreated mixtures of sanitary waste and stormwater, these overflows include large amounts of suspended solids, putrescible organic matter and bacteria which had previously settled to the bottom of sewers and are flushed out during the early stages of storms.

The extent to which stormwater overflows may be affecting the beneficial use of the waters in the Region is not known. Investigations are necessary to determine the quality and quantity of stormwater overflow, the effect such discharges have on the water quality of the receiving waters, and needed remedial measures with associated cost estimates.

Flow Regulation

The Planning Status Reports of the Federal Power Commission indicate that there are over 65 hydroelectric installations in the St. Lawrence Region. To date, there has been no competent assessment of the effect of flow regulation by these hydroelectric facilities on water quality. The last comprehensive water resource survey was the so-called "NENYIAC" Study, completed in 1955. No comprehensive basin studies are currently underway and none are scheduled for the immediate future. There is urgent need for additional studies to evaluate problems associated with hydroelectric flow regulation.

Camping

Camping has become an extremely popular recreation activity because of the topographic features of the St. Lawrence Region. In the Lake Champlain basin in particular, natural resources are accessible and adaptable to recreational purposes, including public and

private camping sites. In 1965, there were over 50 local, private, State and Federal campgrounds throughout the region. While facilities vary at different sites, most are equipped with running water and sanitary facilities. The need for this type of recreational facility has been steadily increasing and considerable effort is being exerted by public and private interests to meet these needs.

There are little data available to indicate the degree wastes originating from campground sites are being treated and the extent to which such wastes may be affecting adjacent waters. Without adequate treatment, these waste discharges result in localized pollution problems and can restrict and even eliminate the use of this natural recreational resource. A survey should be made to determine the extent of this problem.

Thermal Pollution

There are some industrial firms discharging cooling wastewaters into the waters of the Region. These operations generally withdraw large volumes of water for condensing or cooling purposes. After use these waters which contain substantial amounts of heat are returned to the water bodies from which they were withdrawn. Such heated discharges can have a detrimental effect on dissolved oxygen levels and fish and other aquatic habitat of these waters. Fossil fuel (coal, oil, gas) steam electric generating plants may also utilize large quantities of cooling water. The extent to which such plants are operating in the Region needs to be further investigated.

TABLE VI-1

STREAM CATEGORY DESIGNATION
INTER- AND INTRASTATE STREAMS

Name of Lake and/or Stream	Number of Pollution Sources		Category	Problem
	Municipal	Industrial		
St. Regis Basin				
St. Regis Basin Total	9	0		
St. Regis River	4	0	II IV	Mun. Waste Unknown Sources
Pike Creek	0	0	IV	Insufficient Data
Salmon River	1	0	III	Mun. Waste
Little Salmon River (Trib.)	2	0	III	Mun. Waste
Chateaugay River	1	0	II IV	Mun. Waste Unknown Sources
Marble River (Trib.)	1	0	III	Mun. Waste
English River	0	0	IV	Insufficient Data
Trout River	0	0	IV	Insufficient Data
Collins Brook (Trib.)	0	0	IV	Insufficient Data
Oak Creek	0	0	IV	Insufficient Data
Lake Champlain Basin				
Lake Champlain Basin Total	85	61		
Lake Champlain	5	6	II	Mun.-Ind. Waste
			III	Hydrographic conditions, Septic Tanks, recreational boating, commercial navigation eutrophication
			IV	Effects of tributary streams
Great Chazy River	1	1	II	Mun.-Ind. Waste

TABLE VI-1 (Cont'd)

Name of Lake and/or Stream	Number of Pollution Sources Municipal	Industrial	Category	Problem
Lake Champlain (Cont'd.)				
Little Chazy River	1	0	II	Mun. Waste
Saranac River	4	1	II	Mun.-Ind. Waste
			III	Unknown Sources
Twobridge Brook (Trib.)	1	0	II	Mun. Wastes
Behan Brook (Trib.)	2	0	II	Mun. Waste
Little Ausable River	1	0	II	Mun. Waste
			III	Unknown Sources
Ausable River	2	1	II	Mun.-Ind. Waste
Chubb River (Trib.)	1	0	II	Mun. Wastes
Bouquet River	1	0	II	Mun. Waste
Mill Brook	2	1	II	Mun.-Ind. Waste
Ticongeroga Creek	1	2	II	Mun.-Ind. Waste
Champlain Canal	2	0	II	Mun. Waste
			III	Flow regulation, boating, other unknown waste sources
Missisquoi Bay	0	0	IV	Insufficient Data
Missisquoi River (Trib.)	4	10	II	Mun. Waste
			III	Ind. Waste
Trout River (Trib.)	1	0	II	Mun. Waste
Black Creek (Trib.)	0	o	III	Ind. Waste
Lamoille River	5	2	II	Mun. Waste
			III	Ind. Waste flow regulation
Gihon River (Trib.)	1	1	II	Mun. Waste
			III	Ind. Waste septic tanks, agric. drainage

TABLE VI-1 (Cont'd)

Name of Lake and/ or Stream	Number of Pollution Sources Municipal	Industrial	Category	Problem
Lake Champlain (Cont'd.)				
Winooski River	15	7	II III	Mun. Waste Ind. Waste septic tanks, flow regulation
Stevens Branch (Trib.)	4	2	II III	Mun. Waste Ind. Waste septic tanks
Dog River (Trib.)	1	0	II III	Mun. Waste Ind. Waste
Waterbury River (Trib.)	3	0	II	Mun. Waste
La Platte River	2	1	II	Mun.-Ind. Waste
			III	Thermal Pollution
Otter Creek	6	7	II	Mun.-Ind. Waste
			III	Low flow conditions high turbidity, septic tank seepage
Clarendon River (Trib.)	1	1	II III	Mun. Waste Ind. Waste
Furnace Brook (Trib.)	1	0	II III	Mun. Waste Septic tanks
Neshobe River (Trib.)	3	0	II	Mun. Waste
Middlebury River (Trib.)	1	0	II	Mun. Waste
New Haven River (Trib.)	1	0	II III	Mun. Waste Septic tanks
East Creek (Trib.)	0	0	III	Septic tanks
Poultney River	1	4	II III	Mun. Wastes Septic tanks, Ind. waste, turbidity, low flow conditions
Castleton River (Trib.)	2	9	II III	Mun. Wastes Septic tanks, Ind. waste, low flow conditions

TABLE VI-1 (Cont'd)

Name of Lake and/or Stream	Number of Pollution Sources Municipal	Industrial	Category	Problem
Lake Champlain (Cont'd.)				
Mettawee River	2	1	II	Mun.-Ind. Waste
			III	Septic tanks
Lake George	2	0	I	
Ray Brook	1	0	I	
Misc. Tributaries	4	3	II	Mun.-Ind. Waste
			III	Ind. Waste septic tank seepage
			IV	Insufficient data
	Lake Memphremagog Basin			
Lake Memphremagog Basin Total	6	2		
Lake Memphremagog	0	0	III	Recreational boating septic tanks
			IV	Effects of tributary streams
Clyde River (Trib.)	4	2	II	Mun.-Ind. Waste
			III	Septic tanks, agricultural drain.
Barton River (Trib.)	2	0	II	Mun. Waste
			III	Septic tanks, agricultural drain.

TABLE VI-2

WASTE SOURCES IN
ST. LAWRENCE REGION
SUMMARY [a]

INTERSTATE WATERS

State	Municipal and Institutional		Federal		Industrial	
	No.	Population Served (000)	No.	Population Served (000)	No.	PE-BOD (000)
New York	29	79.0	1	1.0	9	461.0
Vermont	23	84.0	0	-	32	52.0
	52	163.0	1	1.0	41	513.0

INTRASTATE WATERS

State	Municipal and Institutional		Federal		Industrial	
	No.	Population Served (000)	No.	Population Served (000)	No.	PE-BOD (000)
New York	8	32.0	0	-	0	-
Vermont	38	71.0	1	0.2	24	2.0
	46	103.0	1	0.2	24	2.0
GRAND TOTALS	98	266.0 [b]	2	1.2 [b]	65	515.0 [c]

[a] Population served for municipal sources; population equivalent for industrial determined on a BOD basis using an estimated daily per capita loading of 0.167 pounds of BOD.

[b] Total of known population served.

[c] Total of calculated population equivalents.

VII - DESCRIPTION OF THE AREA

LOCATION

The St. Lawrence study area consists of three major drainage basins located in northeastern New York and western Vermont, the St. Regis basin in New York State, the Lake Champlain basin, shared by New York and Vermont, and the Lake Memphremagog basin in Vermont. The Lake Champlain basin accounts for more than three-fourths of the area. The study area forms a rough triangle, with a base extending 150 miles along the Canadian border, which width narrows to twenty-five miles in the southern portion of Lake Champlain, where the basin limits bisect Washington County, New York and parallel the southern boundary of Rutland County in Vermont. The length of the region, from its southern extremity to the international boundary on the north is 120 miles. The total land area amounts to 9,550 square miles, of which the Lake Champlain basin amounts to 7,370; St. Regis basin 1,640; and Lake Memphremagog basin 540 square miles.

GEOLOGY

The entire study area lies within the Appalachian Highlands, but the region is further sub-divided into geological provinces which correspond roughly to the several drainage basins. The St. Regis River basin forms part of the Adirondack Province, Lake Champlain is a part of the Appalachian Valley Province and the Lake Memphremagog basin is included in the New England Province.

The Adirondack Province which underlies the St. Regis River basin consists of a great, nearly circular mass of igneous and metamorphic rocks of the Pre-Cambrian Age, including granite, gneiss, syenite, anorthosite, sandstone, conglomerate, limestone and marble. Grenville sedimentary rocks and igneous intrusions are intermingled throughout the basin. The highest ground-water yields in this formation are obtained from carbonate rocks and average 15 to 20 gallons per minute. Mineral content of the ground water varies widely, and is dependent upon the particular local formation from which it is obtained.

The Appalachian Valley Province underlying the Lake Champlain basin has two slightly different areas. To the north, bedrock consists chiefly of limestone, dolomite, shale and sandstone, while south of Port Kent it is predominantly crystalline and carbonate rocks. Since a large portion of the basin is covered with unconsolidated deposits of varying degree, very little is known about ground water conditions. It is known that both yield and chemical quality of well waters is extremely variable.

The New England Province bedrock of the Lake Memphremagog area ranges from the Pre-Cambrian to the Ordivician Period. The oldest rocks are gneiss, granitic igneous rocks and marble. Granite, gneiss and schist underlie the lowlands around Lake Memphremagog, and most of the surface is covered with glacial till and outwash, a mantle which is almost non-existent in the uplands. Ground water yields are the greatest in the lowlands but quantitative yield figures are generally not available.

HYDROGRAPHY

Average annual precipitation in the region is about 35 inches, varying from 28 inches on the northwest shore of Lake Champlain to 40 inches in the highlands. Precipitation is distributed fairly evenly over the year. The average annual snow fall ranges from 65 inches in the lowlands to over 100 inches in the mountainous areas. For at least one-third of the year there is a snow cover of one inch or more.

Surface waters in the study area drain to the Atlantic Ocean via the St. Lawrence River. The majority of the flow occurs through the Richelieu River, which drains the Lake Champlain basin. Average flow in this River amounts to 11,700 cfs. The St. Regis River has an average discharge of more than 1,000 cfs and flows directly into the St. Lawrence River.

Lake Champlain, one of the major lakes of the United States, has a surface area of 435 square miles. Although maximum depths approach 400 feet at a point about 10 miles south of Shelburne Point, the extremities are shallow. For example, the greatest depths south of Crown Point are 30 feet, those north of Rouses Point 20 feet, and in Missisquoi Bay 15 feet. Malletts Bay has a maximum depth of about 100 feet, but is almost completely cut off from the rest of the lake by dikes. The northeast arm area, between Malletts and Missisquoi Bays, has depths to 155 feet and depths between 200 and 300 feet are common in the main portion of the lake.

Lake George, the next largest lake in the study area, has an area of 44 square miles and a maximum depth of 180 feet in the southern portion of the lake.

Like most Temperate Zone lakes, both Lake George and Lake Champlain go through one or more annual cycles of stratification and partial or complete overturn and mixing. In such isolated portions of Lake Champlain as Malletts Bay, the deep dissolved oxygen values may go from less than one mg/l to more than nine mg/l in two weeks, depending upon wind conditions. Observations by Potash

and Henson (1966) show significant oxygen depletion from 40 feet to the bottom (approximately 100 feet) in Malletts Bay in late summer. A survey taken during a time nearest maximum stratification (late August in 1965) also showed dissolved oxygen deficits of somewhat more than 50% in the bottom waters of the northeast arm off St. Albans Bay. At that time the thermal gradient (8 to 18°C) was located at depths from 50 to 75 feet, with temperatures of 5.5 to 6.0°C in the waters below 300 feet.

Henson and others estimate that the ratio of the Lake Champlain discharge to the entire lake volume is such that the equivalent of the lake volume is replaced in a relatively short time (less than ten years). Although there is a mean northwards flow of water through the lake, in most portions of the lake it is masked completely by wind driven currents. Because of the usual stratification and the prevailing wind blowing parallel to the long axis of the lake, it is probably not uncommon for surface currents to be at variance with deeper ones. Upwelling may be expected along the upwind edge of the lakes when the winds are moderate to strong, which will contribute to the oxygen depletion in the bottom layers.

Studies by the University of Vermont seem to indicate the presence of three distinct water masses in Lake Champlain. The waters in the main portion of the lake, the northeast arm and Missisquoi Bay could be distinguished on the basis of total alkalinity and the calcium-magnesium ratio. Henson and Potash (1966) also find some evidence that there is a significant source of igneous or ground water intruding into Lake Champlain, as alkalinity and cation concentration decrease going from south to north in the main basin.

SOCIO-ECONOMIC CHARACTERISTICS

Population in the St. Lawrence Region was 443,333 in 1960, the year of the last complete U. S. Census. By 1965, the population was estimated to have increased to 466,600 or about five percent above 1960. Although these estimates indicate that the Region has grown slightly slower than either New York or Vermont as a whole during the five year period, future growth is expected to be more significant as a result of such factors as construction of major highways into and through the area, public and private development of the recreational resources of the area, more intensive development of the area's natural resources, and construction of larger airport facilities around the major cities as well as additional facilities for small private aircraft throughout this recreation rich area. Elaborate, well-planned water supply and wastewater control programs must be developed and administered throughout the St. Lawrence Region or its water resources will be degraded and the growth indicated may never materialize.

The distribution of the population by state and by county in the St. Lawrence Region for the period under discussion is outlined in Table VII-1.

It is estimated that the Region's population will advance 40 percent during the 1960-1990 period to 621,000. The interaction of the above growth factors, some of which are directly related to the steady rise in leisure time, may eventually mean that past population projections have been too conservative.

Projections indicate that Vermont's population, 57 percent of the region total in 1960, will grow to 61 percent by 1990; when an estimated 380,000 Vermonters will inhabit the St. Lawrence Region contrasted with 240,000 New Yorkers.

The economy of the St. Lawrence Region is highly dependent upon its natural resources. Thick forests form the basis for a large pulp, paper and wood-working industry. Majestic mountains, beautiful lakes, and historical heritage make the area an internationally famous tourist attraction. Almost all outdoor sports can be enjoyed at sometime of the year in natural ruggedness, simple comfort or elegance.

An analysis of the employment patterns (wage and salary workers covered by Social Security) in the Region shows it to have a well diversified economic mix of manufacturing, trade and service activities, the principal employment sources which account for 34, 26 and 22 percent respectively of the total covered labor force.

In economic measures however, Vermont occupies a somewhat larger proportion of the Region than New York; with but 57 percent of the population, Vermont has approximately two-thirds of the area's covered workers. Vermont has even higher proportions of selected major economic sectors: mining; transportation; finance, insurance and real estate; and one important minor sector, hotels and other lodging places, but none of these are among the State's largest employers. Vermont's major industrial employers include machinery, electrical machinery, lumber and wood products, and stone, clay & glass. On the basis of dollar output the three major industries are: machinery (except electrical), food and paper - the last two of which are often included among major sources of pollution. Several sources indicate that paper, fabricated metal products and machinery (electrical and nonelectrical) will register the swiftest economic growth in Vermont over the next 20 to 30 years.

In addition to embracing Vermont's largest industrial and population center, the Region contains most of the State's major ski resorts.

The New York State portion of the St. Lawrence Region contains 43 percent of the area's population but only a third of the covered

labor force. The major difference between the distribution of major economic activities in Vermont and New York is the larger proportion of factory jobs and smaller share of service workers in New York.

There is a significant difference in the manufacturing mix however, where in place of the broad diversification of manufacturing industries operating in Vermont, the New York portion of the St. Lawrence Region has a heavy concentration of pulp and paper plants accounting for a third or more of all factory jobs. Although no studies have been done as to the outlook for industrial growth in the New York section, it is anticipated that manufacturing will employ a smaller proportion of the total labor force in the future.

TABLE VII-1

DISTRIBUTION AND PROJECTION OF POPULATION
IN THE ST. LAWRENCE REGION BY REGION
AND COUNTY, 1960 AND 1990

Region and County	Total County Population 1960	HCMC Project % Population 1960	St. Lawrence Region % Population 1960 2/	St. Lawrence Region Population 1960	St. Lawrence Region Population 1990
ST. LAWRENCE REGION TOTAL		2.3 1/		443,331	621,000
New York State					
Clinton	72,722	100.0	100.0	72,722	109,000
Essex	35,300	99.8	90.4	31,911	34,000
Franklin	44,742	84.6	100.0	37,831	42,000
St. Lawrence	111,239	9.3	100.0	10,291	14,000
Warren	44,002	100.0	13.4	5,913	8,000
Washington	48,476	100.0	66.0	32,000	35,000
New York State Total	356,481			190,668	242,000
Vermont					
Addison	20,076	98.8	100.0	19,828	na
Bennington	25,088	94.3	3.5	870	na
Caledonia	22,786	13.0	100.0	2,951	na
Chittenden	74,425	100.0	100.0	74,425	na
Essex	6,083	5.7	100.0	349	na
Franklin	29,474	100.0	100.0	29,474	na
Grand Isle	2,927	100.0	100.0	2,927	na
Lamoille	11,027	100.0	100.0	11,027	na
Orange	16,014	12.2	100.0	1,955	na
Orleans	20,143	100.0	100.0	20,143	na
Rutland	46,719	98.2	100.0	45,890	na
Washington	42,860	99.9	100.0	42,824	na
Vermont State Total	317,622			252,663	379,000 3/

na Projection not available on county basis.
1/ Total 1960 HCMC Project Population - 19,292,000.
2/ Refers only to the St. Lawrence portion within HCMC Project.
3/ Projection represents proportion of State within the Region; see Sources.

Sources: U. S. Bureau of the Census, 1960; Projective Economic Studies of New England, Arthur D. Little, Inc. Cambridge, Mass. 1964-1965; Demographic Projections, New York State Office of Planning Coordination.

VIII - WATER USE

WATER SUPPLY

Present Demands

The following information on present water supply systems in the St. Lawrence Region is based upon the 1963 Public Health Service Municipal Water Facilities Inventory, and on data made available to Project personnel by various State and local agencies.

Within the Region, there are 161 known municipal water supply systems which serve approximately 250,000 persons, with an average daily consumption of 36 MGD or 140 gallons per capita. Of these systems, 129 serving 220,000 persons (88 percent of the total) with 32 MGD rely solely on surface sources. Seventeen systems serving 12,000 persons utilize only ground water sources, and 15 systems serving 22,000 persons use a combination of both surface and ground water sources.

In terms of population served, most of the municipal systems are small. Of the known 161 systems, only 47 serve 1,000 or more persons. Known data on these systems, which account for the water supply needs of over 90 percent of the total population served by municipal supplies are presented in Table VIII-1. The Plattsburgh (27,500 persons), Burlington (50,000) and Rutland (18,325) water systems are the largest in the Region.

Industrial water use in the St. Lawrence Region is estimated to be 60 MGD, all but about 8 MGD of which is self-supplied. Of the total industrial demand, approximately 48 MGD are used in process operations, with the remainder used for cooling, boiler feed water and similar uses. The majority of the self-supplied industries rely on surface sources.

According to the U. S. Census, there are nearly 61,000 rural, domestic and agricultural water supply sources (individual wells and other systems) located throughout the area. It is estimated that these systems supply 20 MGD of domestic and agricultural water to approximately 200,000 persons. Ground water aquifers are the primary source for these supplies.

At the present time, the amount of water used for irrigation is not considered significant, with an estimated average consumption over the frost-free period (roughly 130 days) of 3 MGD. In general, irrigation demands are met mainly by streams or by natural or man-made ponds.

The reliance upon a large number of small surface water sources to meet present municipal, industrial, domestic and irrigation needs has resulted in water supply problems in the Region. The drought of 1962 to 1966 resulted in a severe shortage of water in several areas of the Region. On at least one occasion, Vermont was forced to mobilize the National Guard and initiate trucking of water from Lake Champlain to distribution points in Addison and Rutland Counties to provide water for agricultural and livestock watering purposes.

Future Requirements

The following estimates of future water supply needs in the St. Lawrence Region are based upon population projections as outlined in Section VII of this Report, the present per capita water consumption, and trends in the per capita water consumption for the New York-Vermont area as reported by the Senate Select Committee on Water Resources.

Average daily water consumption in the area at the present time is estimated as 120 gallons per capita. It is projected that by the year 1990 this usage will have increased to approximately 150 gallons per day, 76 percent of which is attributed to domestic, commercial and other public use with the remaining 24 percent allocated to industrial use. This distribution of the projected 1990 per capita water use can vary markedly depending upon the dynamics of growth and demand registered by industry and all other users. Technological advances in home appliances, and changing recreational uses and commercial demands may accelerate the projected upward trend towards more liberal water use patterns.

It is estimated that by 1990 the total water supply needs in the St. Lawrence Region will amount to 90 MGD, with 70 MGD for domestic, commercial and other public use and the balance for industrial requirements. This increased consumption represents a gain of over two and one half the current water usage.

Although future water demands in the self-supplied industrial and in the agricultural categories cannot be predicted accurately at this time, it is assumed that these water uses will nearly double. On this basis, the self-supplied industrial need in the area will increase from 52 MGD to 104 MGD, and the use of water for irrigation will rise from three MGD to six MGD.

Future needs (1990) can be met by the continued preservation and enhancement of the area's surface water and to a lesser extent by the greater development of ground supplies, coupled with proper planning and distribution to offset local shortages. A large surplus of water is available in the St. Lawrence Region to meet future needs.

This surplus supply includes not only the enormous capacity of Lake Champlain, but also many of the major tributary streams where the yield may reach as much as 100 MGD in the lower reaches, including such streams as the Lamoille and Saranac Rivers and Otter Creek. Additional dependable ground water supplies can be developed by many of the water systems throughout the Region.

RECREATION

The waters of the St. Lawrence Region are used intensively for such recreational activities as bathing, boating and sportfishing.

Bathing

Recreational bathing is a major water use throughout the Region. Bathing beaches and facilities are located all along the shores of Lake Champlain, including the municipal beaches at Plattsburgh (Cumberland Bay), Burlington, West Port, and Port Henry as well as on the numerous privately owned beaches. In addition, the many natural and man-made lakes and ponds scattered throughout the mountains and low lands of the St. Lawrence area afford excellent bathing. Lake Placid, Lake George, and Saranac Lake are among the more developed areas where bathing is an important activity for summer visitors. The rivers and streams which drain from the mountains and lakes in the area also provide bathing opportunities. There are many informally managed bathing facilities located all along these water bodies, especially in the lower reaches where water temperatures rise to comfortable bathing levels.

Recreational Boating

Recreational boating is widespread throughout the area. Both Lake Champlain and Lake Memphremagog are extensively used for pleasure boating. Nearly all of Lake Champlain is navigable, and there are over 40 marinas containing approximately 1400 berths scattered along its shores. Principal pleasure boating harbors are Malletts Bay and Shelbourne Bay. The increasing interest in this activity is evidenced by plans for 18 new marinas. A major attraction for the boating enthusiast is the inland navigable waterways which connect Lake Champlain, the St. Lawrence River, the Hudson River and the Great Lakes. Many cabin cruisers with home ports in Albany, New York Harbor, New Jersey, Long Island, Connecticut, the Great Lakes and Canada visit the area during the boating season.

In 1966, more than 500,000 boats were registered in the State of New York, of which 350,000 are power driven. Only 60,000 of these craft have toilet facilities installed. Vermont registered 20,133 boats in 1966, approximately half of which are operated on Lake Champlain. The State of New York estimates that by 1980 the number of

pleasure boats will nearly triple and boating in Vermont is expected to increase at near this same rate. The development of marinas and associated facilities to meet present and future recreational boating needs will result in greater pollution unless closer regulatory and surveillance activity is provided.

Sport Fishing

The St. Lawrence area has a wide variety of fish, fishing opportunities and fish habitat. There is an abundance of both cold and warm water habitat, including many high quality trout streams. Trout fishing has, however, deteriorated in those streams which flow through extensive agriculture lands or highly populated areas. In New York, good trout fishing is reported in the West Branch of the Ausable River, Bouquet River, Great Chazy River, Saranac River and Salmon River. In Vermont, the Browns River is noted for brown trout fishing, as is the lower end of the North Branch of the Winooski River. Rainbow and brown trout are also found in the lower Mad River, lower Dog River, and the middle reaches of the Winooski River. Brook trout can be found in such streams as the upper Missisquoi, upper Lamoille, Gihon, Otter Creek, New Haven, Middlebury, Cold, Mill, Neshobe, Mettawee and the Poultney.

Many of the lakes and ponds provide excellent warm water fishing as do lower segments of most of the rivers. The smallmouth bass, northern pike, pickerel, yellow perch and walleyed pike are some of the more famous warm water species taken.

The Lake Memphremagog drainage basin also offers a variety of good fishing. Brook trout can be found in the headwater streams that make up the larger segments of the principal rivers. Lake Memphremagog has produced some exceptionally fine land locked salmon and trout fishing opportunities.

Both warm and cold water fishing can also be found along sections of the St. Regis, Little Salmon, Salmon, Chateaugay and Deer Rivers.

Waterfowl

The St. Lawrence area is outstanding for its waterfowl hunting. Such activity attracts many resident and nonresident recreation seekers and stimulates business activities. Although most of the habitat is found in the Lake Champlain Basin, the Lake Memphremagog drainage basin also provides habitat for waterfowl of considerable value. Many of the smaller lakes, marshes, potholes and streams found in the lowlands also provide significant waterfowl opportunities.

The Missisquoi National Wildlife Refuge and the Sandbar Waterfowl Refuge both in Vermont, are important waterfowl areas in the Lake

Champlain basin. These were developed by Federal-State action and are operated under joint management.

COMMERCIAL BOAT TRAFFIC

The main commercial shipping in the St. Lawrence Region, is carried on Lake Champlain and through the Champlain Canal (segment of the New York State Barge Canal System).

Commercial traffic on these waterways consist primarily of shallow-draft tankers and barges transporting petroleum products. Other shipments consist of newsprint paper from Canada to New York Harbor with return shipment of fertilizer products and other commodities.

In 1962 an annual freight tonnage of 1.2 million tons was recorded at the summit locks (Champlain Canal) with passage of 740 freight boats. Lake Champlain tonnage is similar to that of the Champlain Canal. Oil pollution could be a serious problem in the canal system since such a large portion of the cargo is petroleum products, and since there is only one bilge discharge facility for the entire waterway above Troy.

TABLE VIII-1

INVENTORY OF MUNICIPAL WATER FACILITIES
SERVING OVER 1000 PERSONS
ST. LAWRENCE REGION

Facility or Community	Est. Pop. Served	Amount Withdrawn (MGD)	
Lake Champlain Basin			
	New York State		
Black Brook, Twp., WD 1	2,000	.3	(E)
Bolton, Twp., WD 1	1,800	.4	
Champlain	1,550	.2	
Dannemora	2,100	.2	
Granville	2,690	.8	
Keeseville	2,190	.2	
Lake George	2,000	.6	
Lake Placid	3,300	.4	(E)
Dannemora, Twp., Lyon Mountain	1,110	.3	
Moriah, Twp., WD 1	1,200	.1	
Moriah, Twp., WD 2	1,500	.2	
Peru, Twp.	1,700	.2	
Plattsburgh	27,500	5.8	
Port Henry	2,000	.2	
Rouses Point	2,400	.5	
Saranac Lake	6,420	1.3	

TABLE VIII-1

INVENTORY OF MUNICIPAL WATER FACILITIES
SERVING OVER 1000 PERSONS
ST. LAWRENCE REGION (Cont'd)

Facility or Community	Est. Pop. Served	Amount Withdrawn (MGD)
Lake Champlain Basin (Cont'd)		
New York State Cont'd)		
Schuyler Falls, Twp., Morrisville	1,350	.2
Ticonderoga	3,570	1.0
Whitehall	3,900	.8
Willsboro, Twp., WD 2	1,715	.2
State of Vermont		
Barre	9,890	1.5
Barre (Crystal Spr.)	1,800	.2
Brandon	2,800	.5
Bristol	1,420	.3
Burlington	50,000	4.3
Colchester	1,500	.2
Enosburg Falls	1,320	.3
Essex Junction	5,500	.3
Fair Haven	2,380	.3
Graniteville	1,000	.1
Hardwick	1,520	.2

TABLE VIII-1

INVENTORY OF MUNICIPAL WATER FACILITIES
SERVING OVER 1000 PERSONS
ST. LAWRENCE REGION (Cont'd)

Facility or Community	Est. Pop. Served	Amount Withdrawn (MGD)	
Lake Champlain Basin (Cont'd)			
	State of Vermont (Cont'd)		
Johnson	1,200	.1	
Middlebury	3,600	.4	
Montpelier	8,500	1.5	
Morrisville	2,100	.3	
Northfield	3,700	.9	
Poultney	2,100	.2	
Proctor	2,000	.3	
Richford	1,700	.2	
Rutland	18,325	3.0	
Saint Albans	9,000	1.5	
Lake Memphremagog Basin			
	State of Vermont		
Barton	1,170	.2	
Newport	5,020	.6	
Orleans	1,240	.1	
Island Pond	1,330	.2	
St. Regis River Basin			
	New York State		
Chateaugay	1,095	.2	(E)
Malone	8,740	1.6	

E = Estimated

Source: 1963 Public Health Service Inventory.

APPENDIX A

CRITERIA FOR PRIORITY DETERMINATION

A system of priority ranking was developed for municipal and industrial construction needs, based on a series of criteria which indicate the urgency of abatement for each waste source. These criteria, which are in the form of a weighted scoring system, were applied to each known waste source. All sources were then ranked on the basis of final score, and divided into four priority groups, on the basis of engineering and economic judgment.

The criteria used to evaluate and rank the municipal treatment needs are presented in Table A-1. The scoring system includes such factors as existing treatment type, BOD loading discharged, size and use of the receiving stream, and previous enforcement activity.

A separate set of criteria which recognize the variation in industrial waste characteristics, were developed to rank industrial needs by priority. These criteria, shown in Table A-2, include such factors as waste toxicity, solids and color in addition to the factors used for municipal waste.

TABLE A-1

PRIORITY CRITERIA - MUNICIPAL WASTES

Aggregate Weight Adjusting Factors

		Percent
I	Type of Treatment.	35
II	Population Equivalents (P.E.)-Discharged (BOD) . . .	25
III	Receiving Water Use and Dilution	35
IV	Prior Orders Issued.	5

Enumerated Categories by Weight

I.A Type of Treatment

Bases	Wt.
No Treatment	100
Primary - No Chlorine - Overloaded	90
Primary - Chlorine - Overloaded	80
Primary - No Chlorine - Within design	70
Primary - Chlorine - Within design	60
Intermediate - No Chlorine - Overloaded	80
Intermediate - Chlorine - Overloaded	70
Intermediate - No Chlorine - Within design	50
Intermediate - Chlorine - Within design	40
Secondary - No Chlorine - Overloaded	70
Secondary - Chlorine - Overloaded	60
Secondary - No Chlorine - Within design	30
Secondary - Chlorine - Within design	0

II.A P. E. Discharged

BOD Range	
0 - 100	5
100 - 1000	10
1000 - 10,000	25
10,000 - 100,000	50
Over 100,000	100

III.A Receiving Water Use and Dilution

A Use

Drinking Water	80
Shell Fishing and/or Recreation	38
Sport Fishing	25
Other Uses	10

B Dilution

Large	0
Medium	15
Small	50

TABLE A-1 (CONT'D.)

IV.A	Prior Orders Issued	Wt.
	Yes	100
	No	0

TABLE A-2

PRIORITY CRITERIA - INDUSTRIAL WASTES

Aggregate Weight Adjusting Factors

		Percent
I	Effluent Waste Characteristics.	30*
II	Volume of Wastes.	30
III	Receiving Water Use and Dilution.	40

Enumerated Categories by Weight

I	Effluent Waste Characteristics*	Percent of Wt.
A.	Bacteria	
	less than 1 x 10^5 total coliform/100 ml	5
	between 1 x 10^5 to 1 x 10^6 total coliform/100 ml	20
	greater than 1 x 10^6 total coliform 100 ml	30
B.	BOD	
	less than 20 mg/l	0
	20 - 100 mg/l	5
	100 - 300 mg/l	10
	300 - 600 mg/l	15
	greater than 600 mg/l	20
C.	Color and/or foam	
	if significant in stream	5
D.	Floating Solids - oil, grease	
	if significant in stream	10
E.	pH	
	less than 5 or greater than 10	5
F.	Temperature rise	
	greater than 5°F in stream	10

TABLE A-2 (CONT'D.)

G. Total Suspended Solids	
less than 75 mg/l	0
75 - 200 mg/l	10
greater than 200 mg/l	20
H. Toxic Chemicals	
toxic to fish in stream	50

*It can be noted that on the basis of the percent of weight, that the total weight of 30 can be exceeded. This is necessary in order to develop the proper priority when considering highly significant waste characteristics.

II A. Volume of Wastes			Percent of Wt.
Item			
1,000	-	10,000 gal. per day	10
10,000	-	100,000 gal. per day	20
100,000	-	1,000,000 gal. per day	50
1,000,000	-	5,000,000 gal. per day	100
greater than 5,000,000 gal. per day			150

III Receiving Water Use & Dilution	Percent of Wt.
A. Use	
Drinking Water	80
Shell Fishing and/or Recreation	38
Sport Fishing	25
Other	10
B. Dilution	
Large	0
Medium	15
Small	50

APPENDIX B

CONSTRUCTION ACTIVITY CODING

Two basic assumptions were used throughout in determining construction needs. Minimum acceptable treatment was defined as secondary treatment for municipal waste or its equivalent for industrial waste. All existing treatment plants constructed more than 20 years ago were considered obsolete and in need of complete replacement.

A system of construction coding was formulated to indicate the kind and amount of construction activity required to abate each municipal and industrial waste discharge. Each source was coded by an activity as shown in Tables B-1 (Municipal) or B-2 (Industrial).

TABLE B-1

MUNICIPAL CONSTRUCTION ACTIVITY CODES

Type of Facility	Status of Waste Source	Code Number
No Plant	Discharging raw sewage-build primary and secondary plant	01
Primary Plant	Not suitable for upgrading to secondary, build a new secondary plant	02
	Suitable for upgrading to secondary, if overloaded build secondary for overload	04
Intermediate Plant	Not suitable for upgrading to secondary, build a new secondary plant	03
	Suitable for upgrading to secondary, if overloaded build secondary for overload	05
Secondary Plant	Condition Good - if overloaded build secondary for overload only	06
	Condition Fair to Poor - if not overloaded continue to use	07
	Condition Fair to Poor - If overloaded build new secondary for total load	08
Any Plant or No Plant	Do not build or reconstruct, plant to be shut down and load picked up by another plant (load has been added to other unit)	09
	Replace septic tanks with new plant and collection system	10

TABLE B-2

INDUSTRIAL CONSTRUCTION ACTIVITY CODES

Code Number	Type of Activity
A	Provide secondary treatment or equivalent, including chlorination
B	Provide secondary treatment or equivalent
C	Provide for segregation and separate treatment of one or more types of waste that may include suspended solids, toxic matter, oil and/or grease, color and high or low pH
D	Same as C; plus biological treatment for all or part of the wastes, including chlorination

APPENDIX C

COST ESTIMATING PROCEDURES

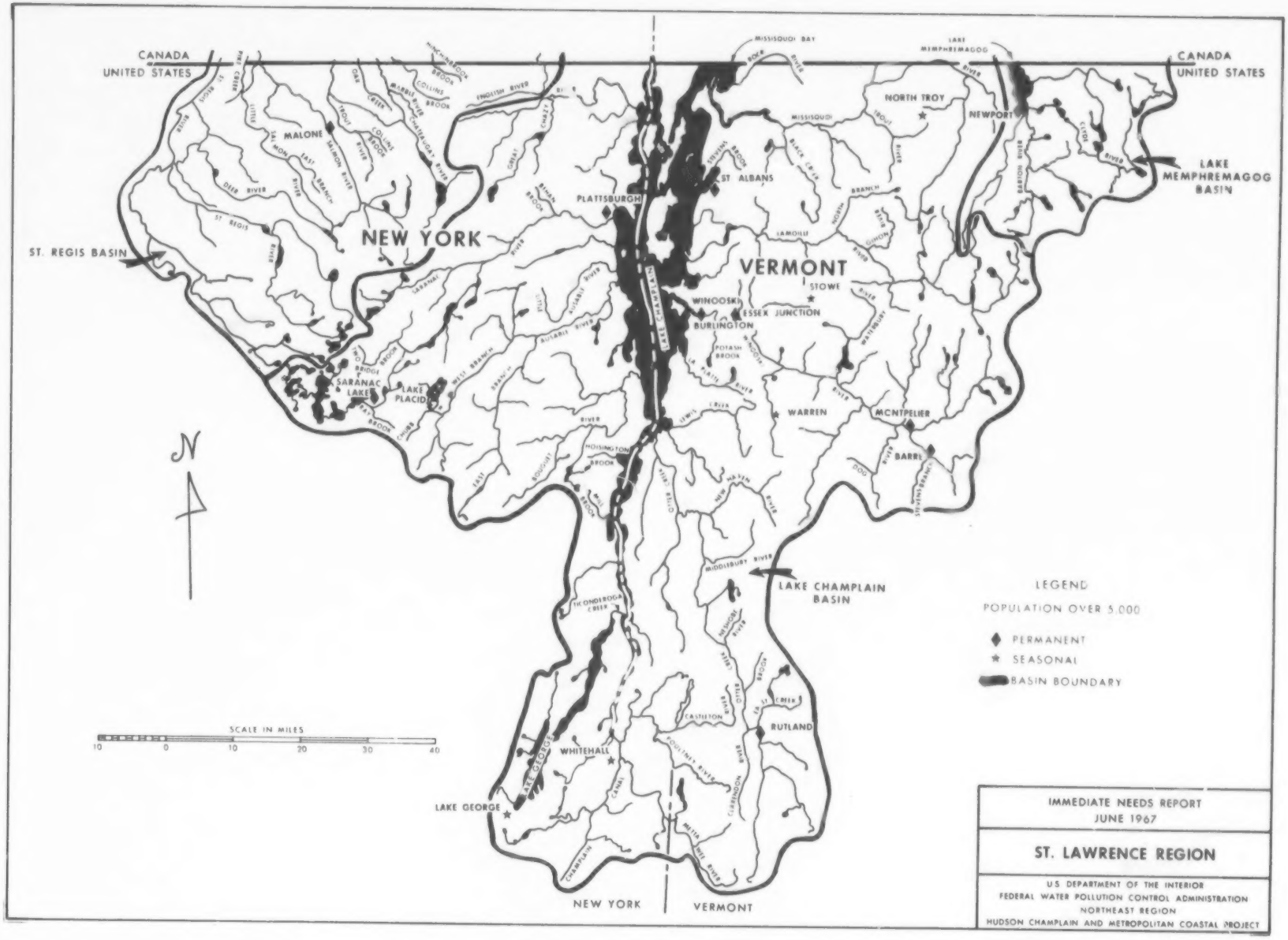
Estimated costs of needed municipal construction activities were developed, using as a basis an unpublished study of sewage treatment needs in the Hudson River basin above Chelsea, New York.[1/] This study presented a sliding scale of unit cost by population served and by type of construction required.

In developing cost estimates, it was recognized that waste treatment facilities constructed in the immediate future should be designed for anticipated population growth through 1990, to allow for a plant life of 20 years. However, since no data are available to provide reasonable projections of sewered population on an individual plant basis, estimates were prepared for the region as a whole and then adjusted to reflect the needed additional capacity.

A basic cost was calculated for each municipal plant, using the present population served, the needed construction activity and the unit cost data. The results were summed for each priority and construction activity code and corrected by the FWPCA construction cost index projected to 1970. A 20 percent factor was then added to cover engineering, legal and other services, after which the cost estimates were revised to reflect the anticipated regional growth through 1990. Cost estimates for ancillary works, such as interceptor sewers, pumping stations and force mains were calculated as 83 percent of the treatment plant cost, based on the Study referred to above.

Industrial cost estimates were prepared by assuming equivalency between the costs of industrial and municipal plants to treat the same magnitude of organic loadings, expressed in terms of population equivalents, with the results projected to 1990 on the basis of anticipated growth of industrial water use. Ancillary works, such as process changes and segregation of wastes, were estimated as 50 percent of the treatment plant cost.

1/ Basic Data Branch, DWSPC, Public Health Service (now Division of Pollution Surveillance, Technical Programs, FWPCA) August 10, 1965, Subject "Sewage Treatment Needs in Hudson River Basin above Chelsea"


CANADA
UNITED STATES
CANADA
UNITED STATES
MISSISQUOI BAY
LAKE MEMPHREMAGOG
NORTH TROY
NEWPORT
LAKE MEMPHREMAGOG BASIN
MALONE
ST. ALBANS
PLATTSBURGH
NEW YORK
ST. REGIS BASIN
VERMONT
STOWE
WINOOSKI
ESSEX JUNCTION
BURLINGTON
SARANAC LAKE
LAKE PLACID
WARREN
MONTPELIER
BARRE
N
LAKE CHAMPLAIN BASIN
LEGEND
POPULATION OVER 5,000
PERMANENT
SEASONAL
BASIN BOUNDARY
SCALE IN MILES
10 0 10 20 30 40
WHITEHALL
RUTLAND
LAKE GEORGE
NEW YORK
VERMONT
IMMEDIATE NEEDS REPORT
JUNE 1967
ST. LAWRENCE REGION
U.S. DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION
NORTHEAST REGION
HUDSON CHAMPLAIN AND METROPOLITAN COASTAL PROJECT